精準醫學數據研究

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馮已榕

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2020 生醫形象影片-未來的我們(中文版)
https://www.youtube.com/watch?v=Yz2lheXkuxM&feature=youtu.be

Decision Making

- How many decisions does an adult make per day?
- How many food-related decisions does an adult make per day?

- How many medical decisions does an doctor make per day?

Decision Making

- How many decisions does an adult make per day? **35’ 000/day**
- How many food-related decisions does an adult make per day?

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Decision Making

- How many decisions does an adult make per day? **35’ 000/day**
- How many food-related decisions does an adult make per day? **226.7/day** Brian Wansink, *Mindless Eating: The 200 Daily Food Decisions We Overlook*, 2007
- How many medical decisions does an doctor make per day?

Medical Decision Making

- How many decisions does an adult make per day? **35’ 000/day**
- How many food-related decisions does an adult make per day? **226.7/day** Brian Wansink, *Mindless Eating: The 200 Daily Food Decisions We Overlook*, 2007
- How many medical decisions does an doctor make per day? **pediatric cardiologists 158/day**
  Jeffrey R. Darst MD, Deciding without Data, 2010

什麼是醫學(medicine)?

如何預防?

Predict | Disgnose | Treat | Monitor

保護因子

危險因子

如何診斷?

Predict | Disgnose | Treat | Monitor

- 症狀
- 身體檢查 {性別、年齡、身高、體重、心跳、血壓...}
- 病史
- 家族史
- 病理中心檢驗數據 {血液常規檢查(白血球、紅血球、血色素...)、生化檢查(糖化血色素、膽固醇...)、血清學檢查...}
- 醫療影像{x-ray 、CT 、MRI...}

如何診斷?

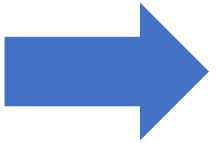
Predict | Disgnose | Treat | Monitor

- **症狀** - 腹部疼痛，有時甚至會感到胸部或右肩胛骨疼痛，無論如何改變姿勢都無法減輕疼痛。
- **身體檢查** –

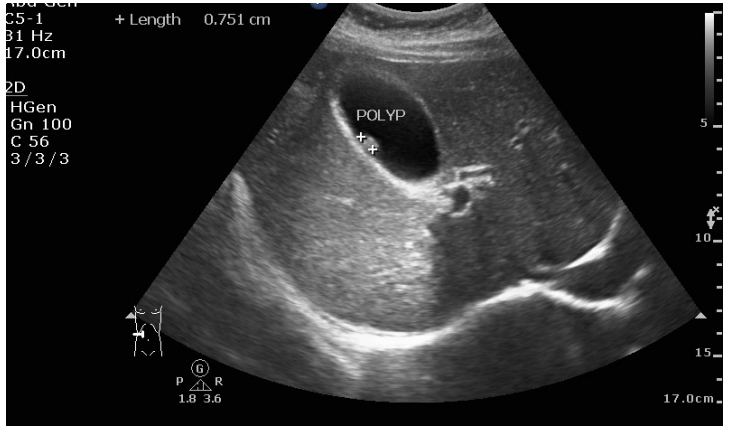
  大於40歲

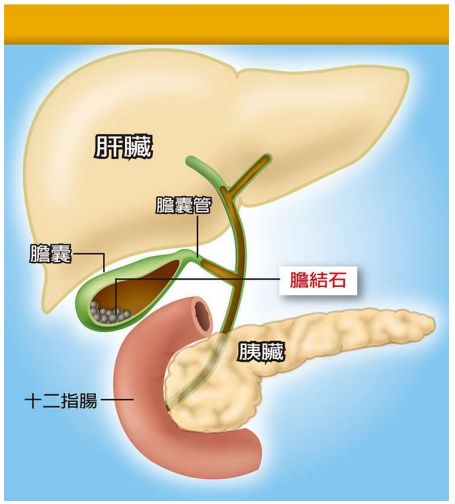
  女性

  肥胖者（BMI>30）
- **病史**
- **家族史**-有膽結石家族
- **病理中心檢驗數據**
- **醫療影像** - 腹部X光檢查、電腦斷層掃描或腹部超音波



膽結石





"年度前廿大疾病衛教：認識膽結石"
https://802.mnd.gov.tw/ListP0003102.ShowItemListState.do?StateEvent=InitEvent&QueryRecord.ArticleId=2016-09-02%2009:55:01#:~:text=%E7%94%B1%E6%96%BC%E8%82%A5%E8%83%96%E6%98%AF%E8%86%BD%E7%B5%90%E7%9F%B3,%E6%96%BC%E9%A0%90%E9%98%B2%E8%86%BD%E7%B5%90%E7%9F%B3%E5%BD%A2%E6%88%90%E3%80%82

如何診斷?

- **症狀** -尿多、口渴、飢餓、疲勞、視力模糊、體重減輕或傷口不易癒合

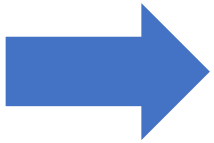
  吃多、喝多、尿多 + 體重減少 (三多一少)
- **身體檢查**- 40歲以上? 肥胖?
- **病史**
- **家族史**- ?
- **病理中心檢驗數據** –

  1. 隨機血漿糖值（無論空腹與否的任意時間測得的血糖值）≥200（單位：mg/dl, 毫克/分公升）

  2. 空腹8小時後血糖 ≥126 mg/dl。

  3. 空腹口服75公克葡萄糖後測試（此檢查稱為葡萄糖耐受試驗），在2小時的血糖值≥ 200 mg/dl。

  4. 糖化血色素 (HbA1C) ≥6.5%。
- **醫療影像**



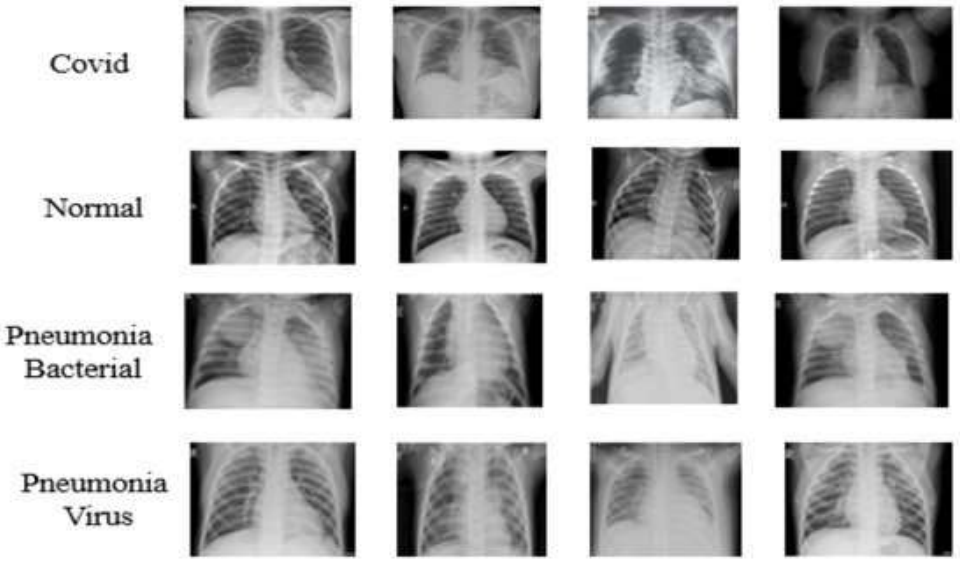
第2型糖尿病

如何診斷?

Predict | Disgnose | Treat | Monitor

- **症狀-**
  發燒(≧38℃)
  急性呼吸道感染或嗅、味覺異常。
- **身體檢查**
- **病史**
- **家族史**
- **病理中心檢驗數據 –**
  1.臨床檢體(如鼻咽或咽喉擦拭液、痰液或下呼吸道抽取液等)分離並鑑定出新型冠狀**病毒**。
  2.臨床檢體新型冠狀**病毒**分子生物學核酸檢測陽性。
  醫療影像
  放射線診斷顯示有肺炎。

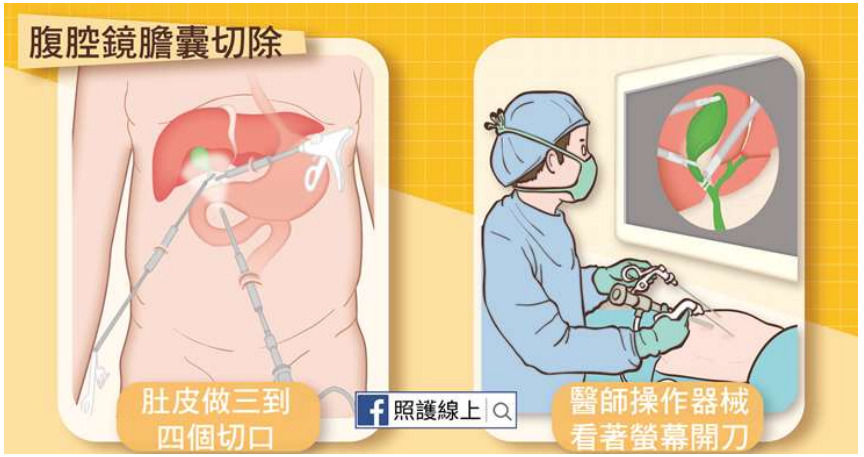
→ **COVID-19 (武漢肺炎)**



如何治療?

Predict → Disgnose → Treat → Monitor

膽結石 → 膽囊切除手術



第2型糖尿病 → 胰島素/降血糖藥物

糖尿病指的是人體內的胰臟不能製造足夠的胰島素，導致葡萄糖無法充分進入細胞內，血糖濃度就會升高形成糖尿病。

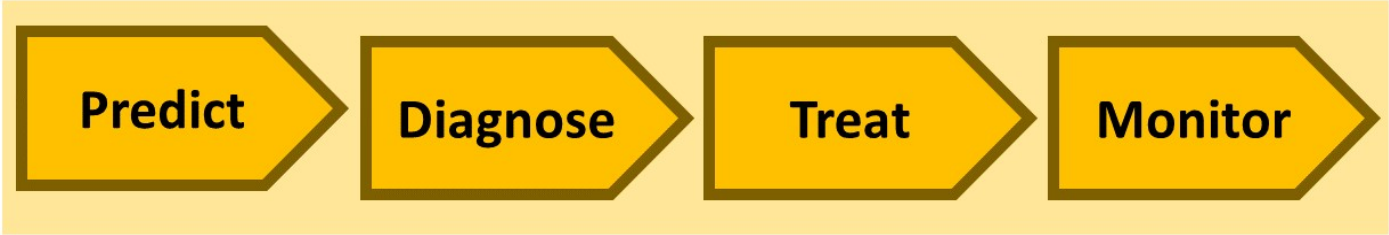
財團法人蘭陽仁愛醫院－糖尿病

COVID-19 → 呼吸器

如何追蹤?

- 症狀
- 身體檢查 {性別、年齡、身高、體重、心跳、血壓...}
- 病史
- 家族史
- 病理中心檢驗數據 {血液常規檢查(白血球、紅血球、血色素...)、生化檢查(糖化血色素、膽固醇...)、血清學檢查...}
- 醫療影像{x-ray 、CT 、MRI...}

Medical Decision Making



- 哪一種**膽固醇類藥物**比其他藥物更能**防範心臟病**的發作呢？
- **診斷癌症**最可靠的檢測方法是什麼？
- **減輕膝痛**的最佳方式是什麼呢？

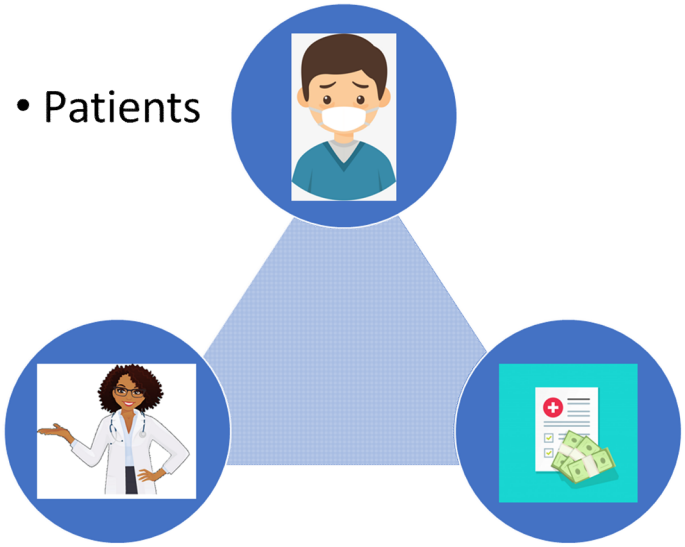
Wharton
University of Pennsylvania

病患導向結果分析機構(Patient-centered outcomes research institute)

比較效果研究 (comparative effectiveness research) : 比較療法間「相對健康影響、臨床效用及適用性」

常春月刊 • 5 小時前

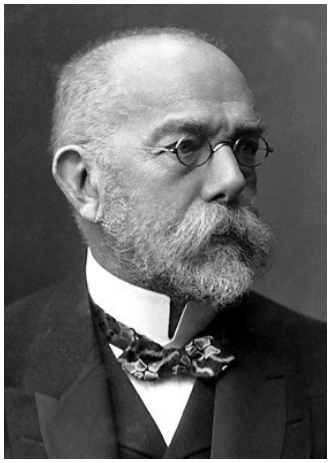
肥胖增加女性早期髖部骨折的機率　尤其骨密度低於平均值風險更高



傳統研究方式

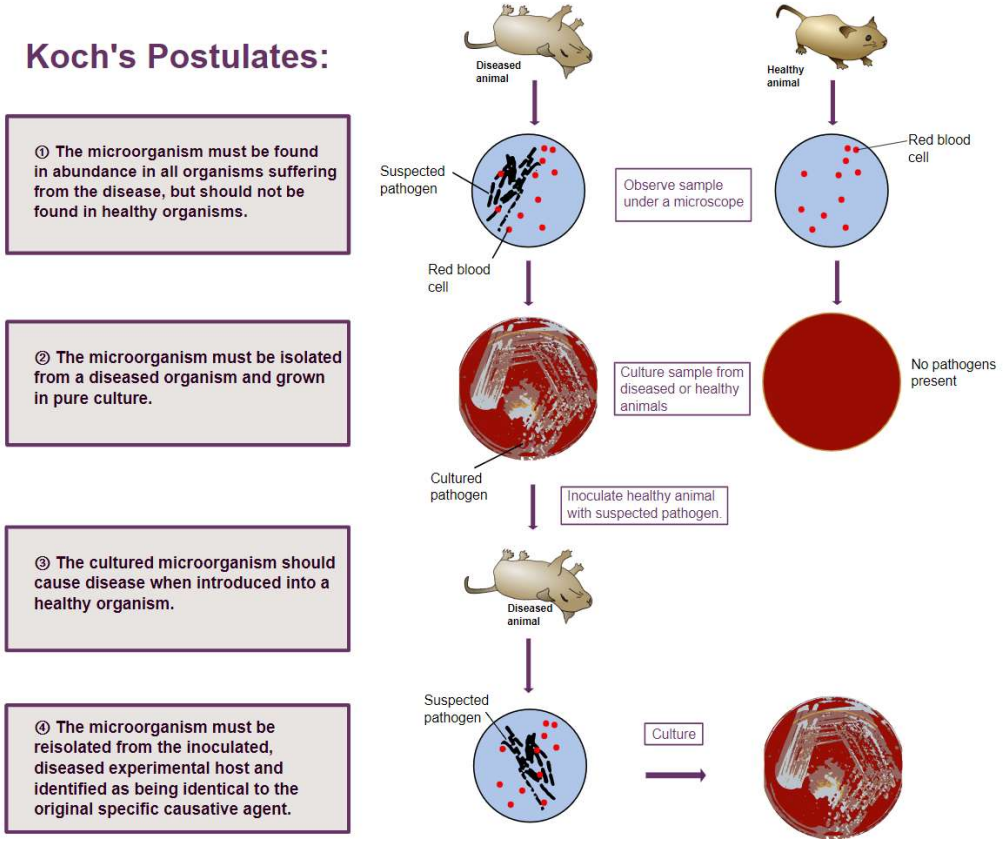
Koch‘s postulates

描述疾病（通常是傳染病）與病原菌之間因果關係的條件

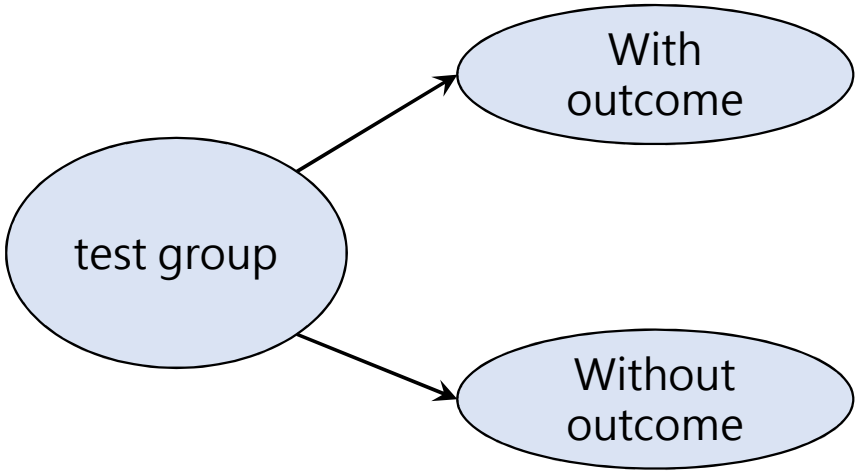


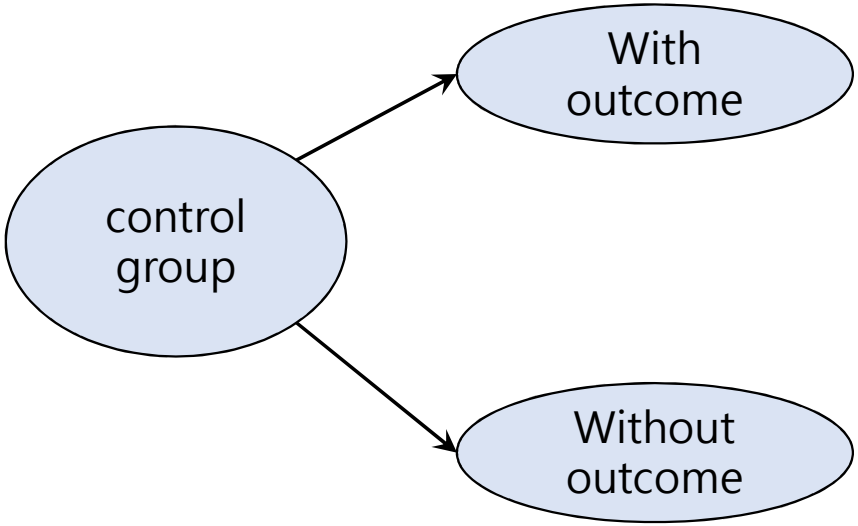
德國醫師 / 生理學家Robert Koch。
Image courtesy of Nobelprize.org

1. 病體身上可以找到大量致病病原菌，而在健康活體上找不到這些病原菌。
2. 這些病原菌可以從病體身上分離出，而且可以在適當的培養基上生長。
3. 培養出的病原菌可以造成原本健康的活體患病。
4. 從這些因為接種了培養出的病原菌而患病的病體身上，可以再次分離出和原先培養一樣的病原菌菌種。



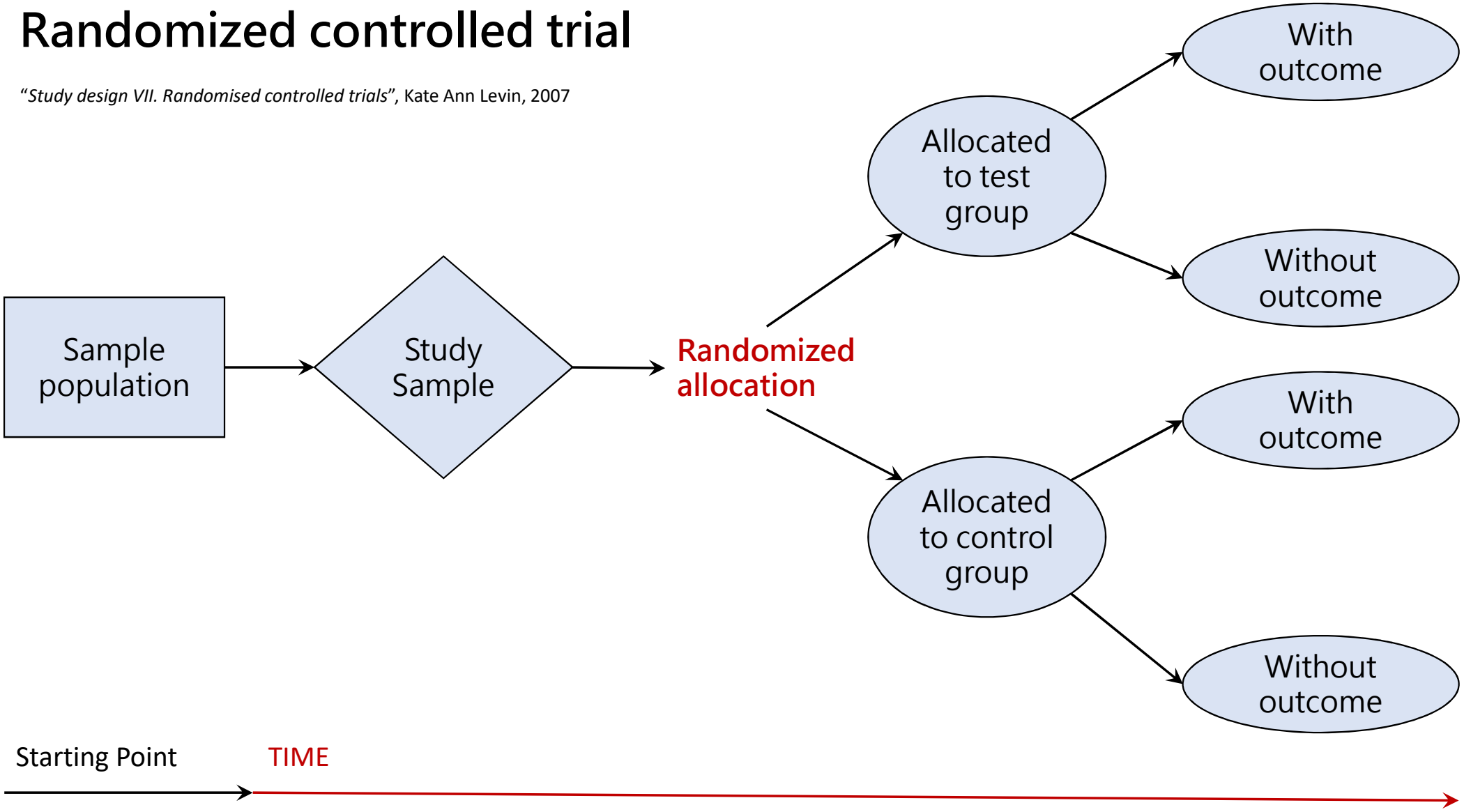
“菌群培養大師：1905年第五屆諾貝爾生理學醫學獎得主Robert Koch的研究工作回顧”
https://pansci.asia/archives/47780


test group
With outcome
Without outcome

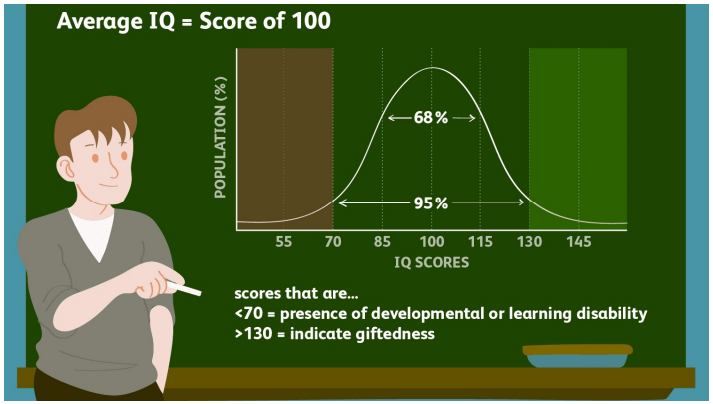

control group
With outcome
Without outcome

Randomized controlled trial

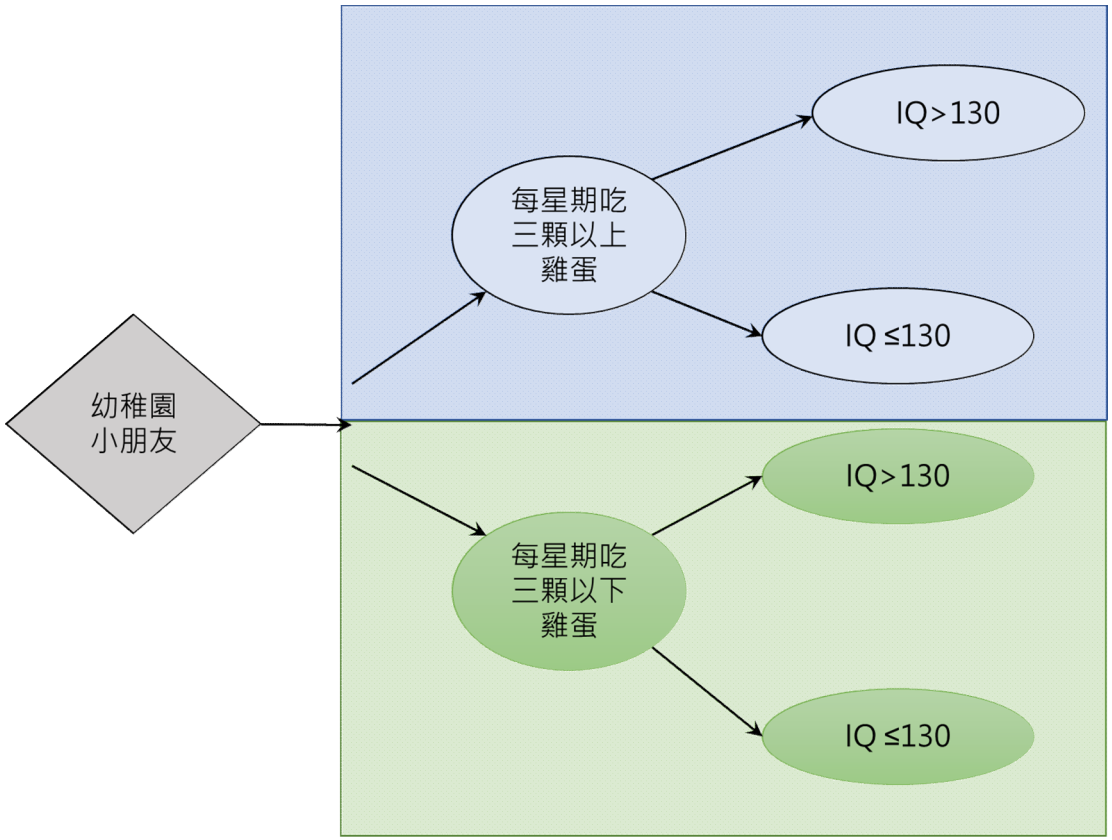
"*Study design VII. Randomised controlled trials*", Kate Ann Levin, 2007



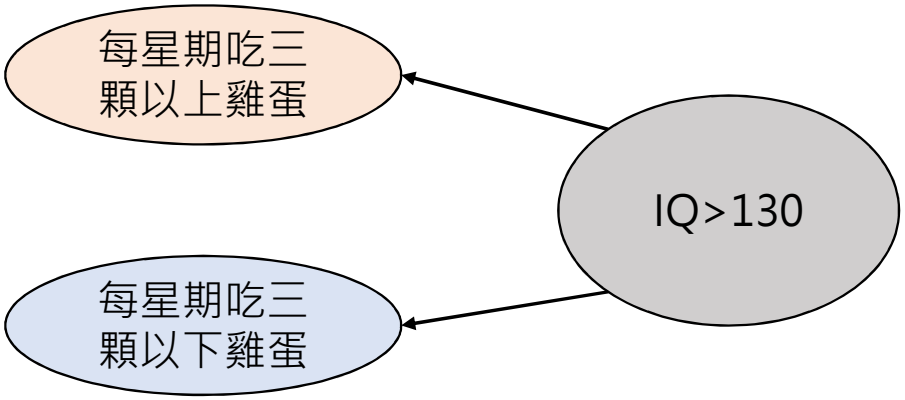

Heho
吃什麼會變聰明？
有助兒童大腦發育的８種食物
❶雞蛋
優質蛋白質與卵磷脂，促進腦部發育、保護神經系統
❷魚類
良好 omega-3 來源，對學習困難和閱讀障礙有幫助
❸堅果
堅果中富含次亞麻油酸，是腦部細胞發育的關鍵
❹糙米
含維生素 B 群，避免腦部發育異常，並增加纖維攝取
❺深綠色蔬菜
富含維生素、礦物質和植化素，是發展腦部的重要元素
❻海藻類
「碘」的重要來源，若缺乏會影響孩童的心智發育
❼牛奶
牛乳
含鈣質、蛋白質與維生素 B 群，供組織和大腦發育所需
❽優格
YOGURT
提供蛋白質、鈣質與益生菌，讓學習力和專注力更加分
Heho健康

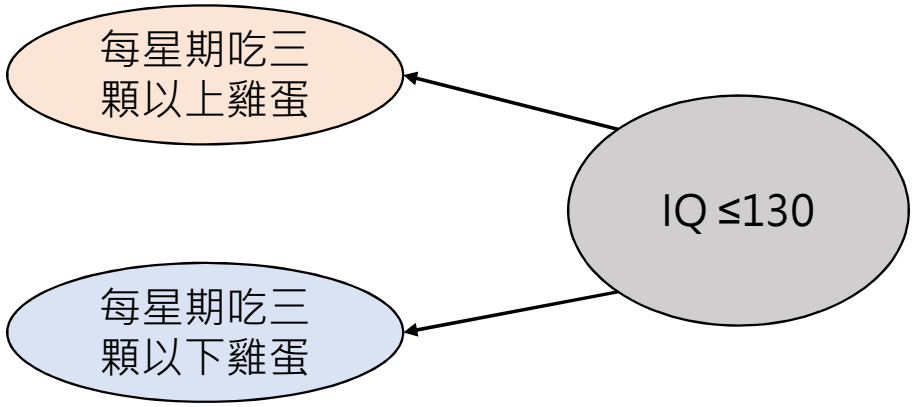

Average IQ = Score of 100
POPULATION (%)
68%
95%
55 70 85 100 115 130 145
IQ SCORES
scores that are...
<70 = presence of developmental or learning disability
>130 = indicate giftedness

“吃雞蛋”是否與”IQ”相關?

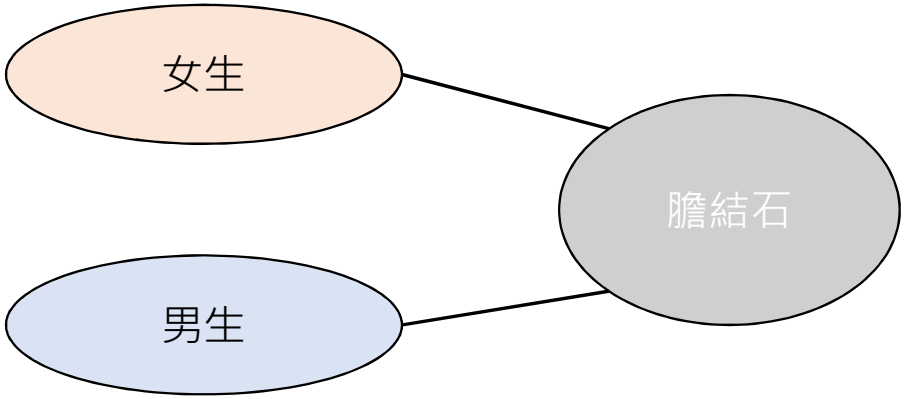

幼稚園
小朋友
每星期吃
三顆以上
雞蛋
IQ>130
IQ ≤130
每星期吃
三顆以下
雞蛋
IQ>130
IQ ≤130

“吃雞蛋”是否與”IQ”相關?

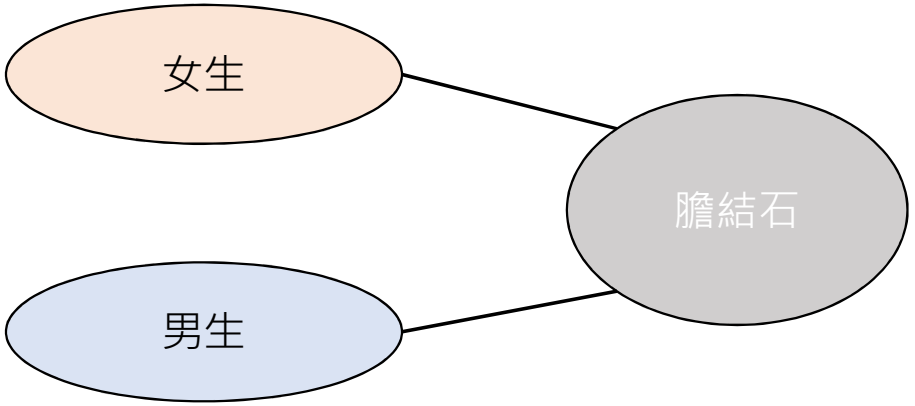

每星期吃三
顆以上雞蛋
每星期吃三
顆以下雞蛋
IQ>130


每星期吃三
顆以上雞蛋
每星期吃三
顆以下雞蛋
IQ ≤130

“性別”是否與”膽結石”相關?
“年齡”是否與”膽結石”相關?
“肥胖”是否與”膽結石”相關?



“標靶藥物”是否與”癌症治癒”相關?



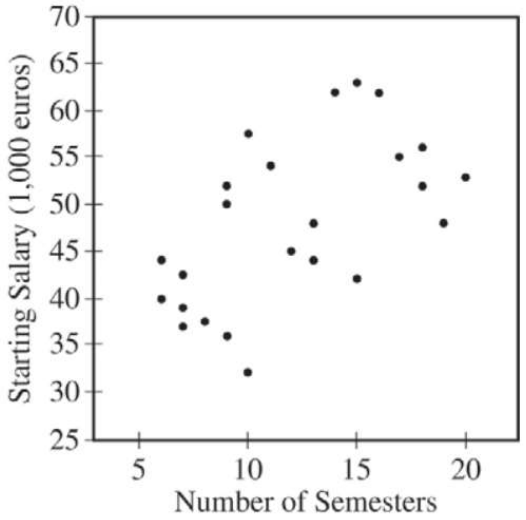
Multivariable thinking 多元思考

Ref: *Developing Multivariable Thinking,* Roxy Peck

Does Taking Your Time in College Pay Off?

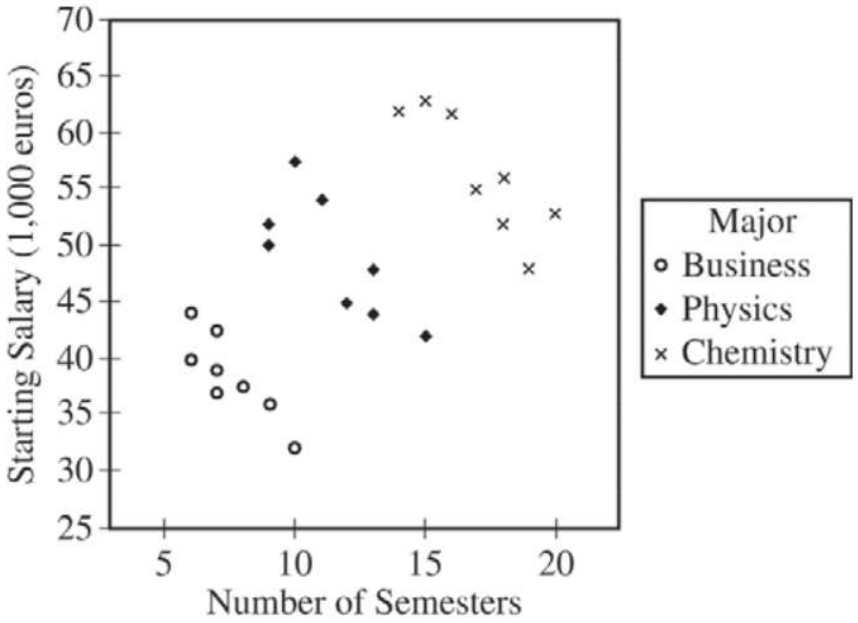
-- 2016 AP Statistics Exam

"A newspaper in Germany reported **that the more semesters need to complete an academic program at the university, the greater the starting salary in the first year of a job**. The report was based on a study that used a random sample of 24 people who had recently completed an academic program. Information was collected on the number of semesters each person in the sample needed to complete the program and the starting salary, in thousands of euros, for the first year of a job."



a. Does the scatterplot **support** the newspaper report about number of semesters and starting salary?

"An independent researcher received the data from the newspaper and conducted a new analysis by separating the data into three groups based on the major of each person. A revised scatterplot identifying the major of each person is shown below."



c. Based on the people in the sample, **describe the relationship between starting salary and number of semesters for the business majors**.

e. Based on the analysis conducted by the independent researcher, how could the newspaper report be **modified to give a better description** of the relationship between the number of semesters and the starting salary for the people in the sample?

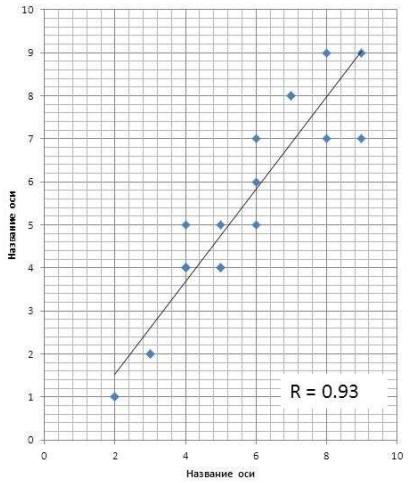
Multivariable thinking

Confounding Variables

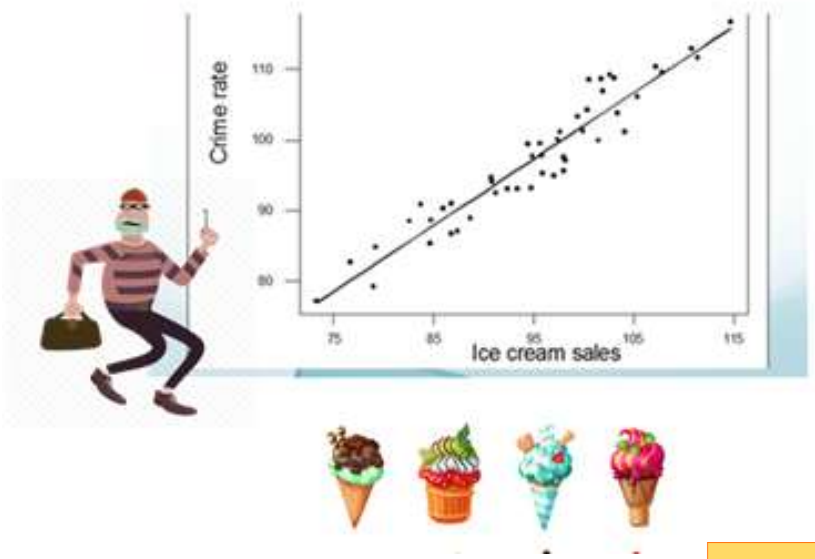
A Concern in Observational Studies and Poorly Designed Experiments

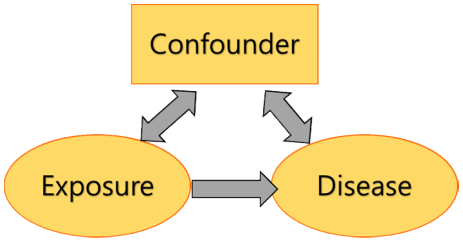
Are the variables of a child's shoe size and their reading ability correlated?

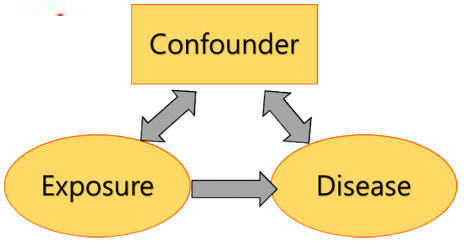
Shoe size	Reading ability
4	4
5	5
6	7
4	5
5	4
6	5
4	4
5	4
6	6
7	8
8	9
9	9
7	8
8	7
9	7
2	1
3	2
4	4
2	1
3	2
4	4



Crime rate and ice cream sales

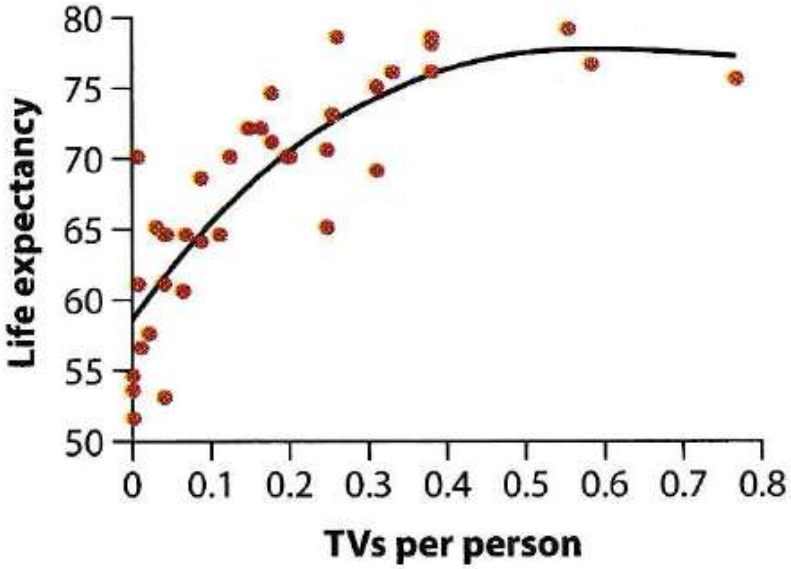




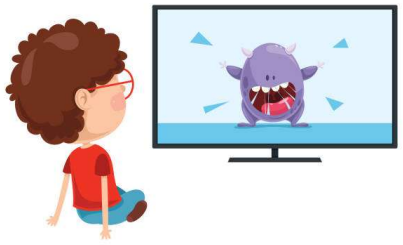


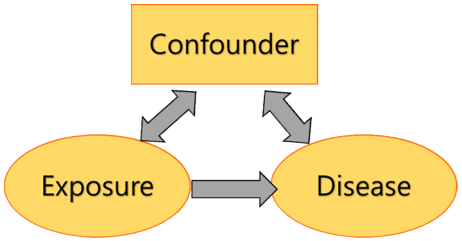
Confounding Variables

A Concern in Observational Studies and Poorly Designed Experiments



There is a **strong positive relationship** between **number of televisions per household** and **life expectancy** for countries in the world.





新研究工具

2016年韓國棋王李世乭代表人類出戰Google DeepMind開發的AlphaGo

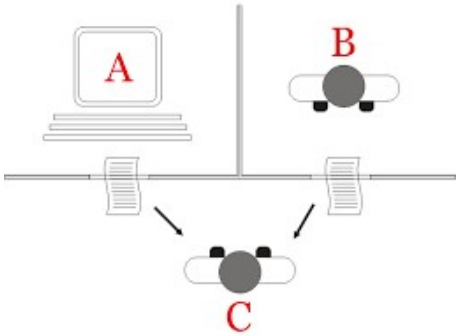
【纪录片】AlphaGo世紀對決 2017_剪接

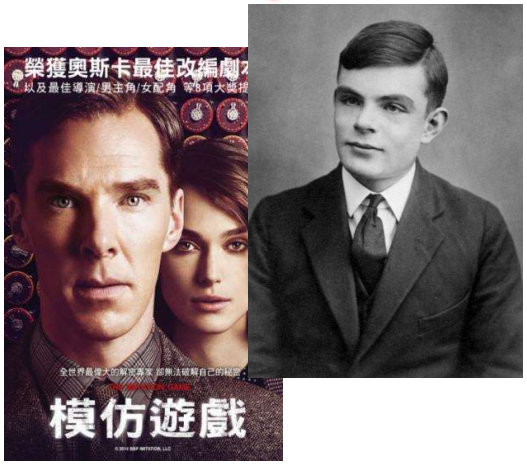
Artificial intelligence is the field of computer science that is associated with the concept of machines "**think like humans**" to perform tasks such as **learning, problem-solving, planning, reasoning and identifying patterns.**

1950

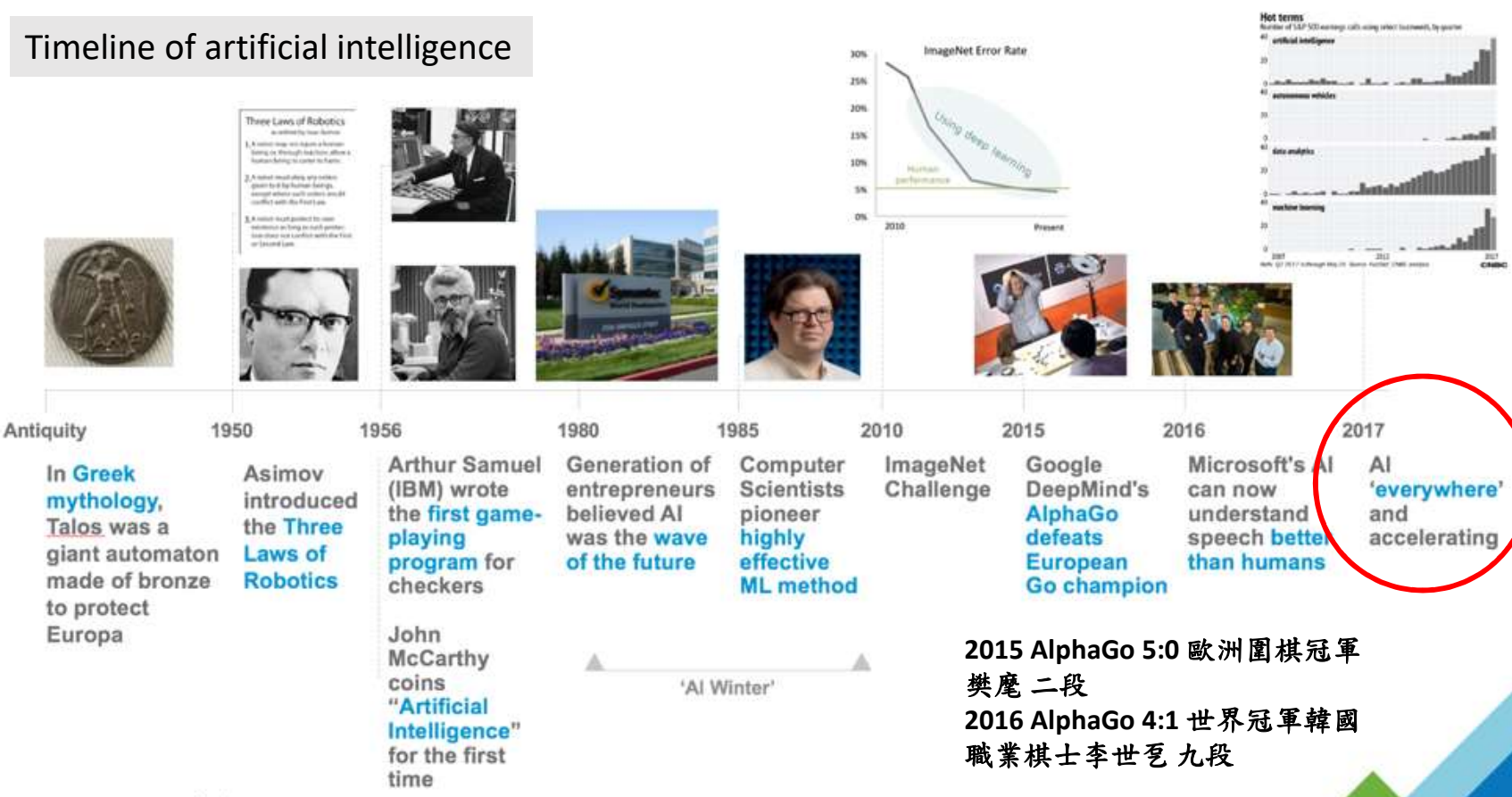
圖靈測試 (Turing test)

判斷機器是否能夠思考的實驗





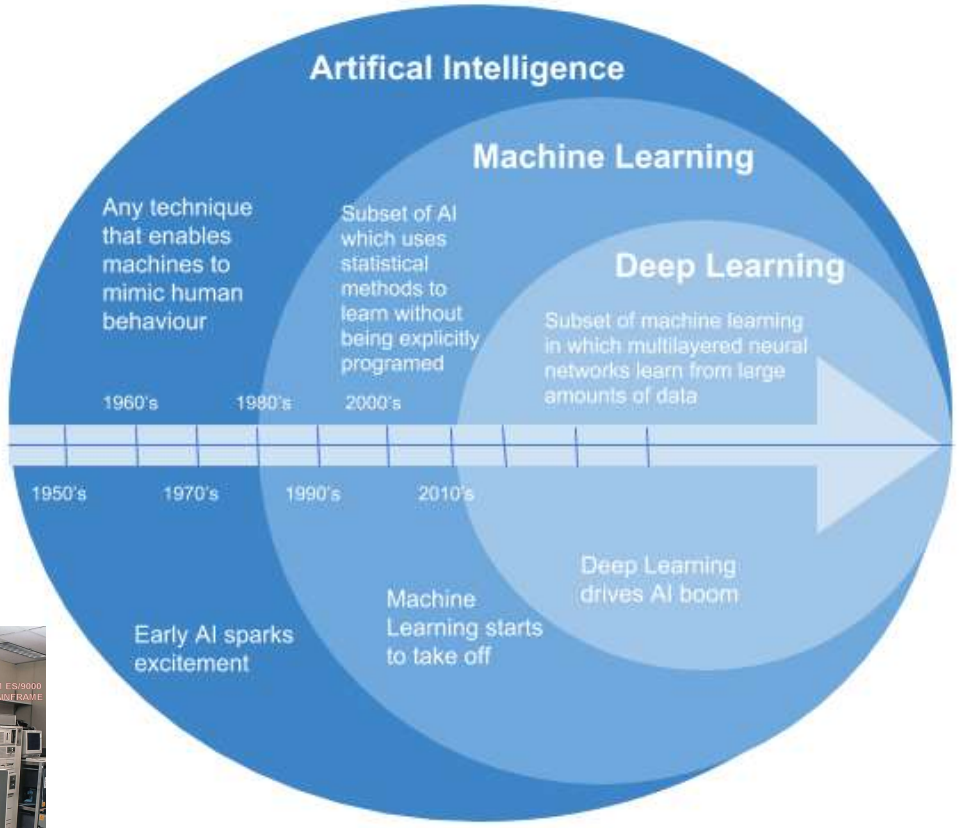
Timeline of artificial intelligence



2015 AlphaGo 5:0 歐洲圍棋冠軍樊麾 二段

2016 AlphaGo 4:1 世界冠軍韓國職業棋士李世乭 九段

人工智慧:
計算機模仿人類思考進而模擬人類的能力/行為。



傳統規則式專家系統 (rule-based expert system)
輸入了人類的200多萬局棋譜
計算出每一步棋後面的12步變化
最強的人類只能計算10步

專家系統是一個知識庫(Knowledge-based)，設計用來解決特定領域(Specific domain)的問題

深藍(Deep Blue)
專門分析西洋棋

許峰雄
生於台灣基隆
1980年畢業於臺灣大學電機系
1989年獲得美國卡內基美隆大學電腦科學博士學位

分辨貓或是狗

專家系統:

狗是汪汪叫，貓是喵喵叫

狗比較大隻，貓比較小隻

鼻子形狀

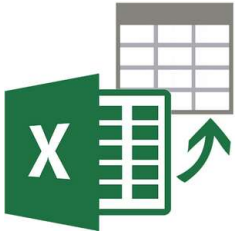
腳印

機器學習(Machine Learning)

經過資料觀察，特徵萃取，模型建立的過程得到可以歸納/學習出有用規則的模型

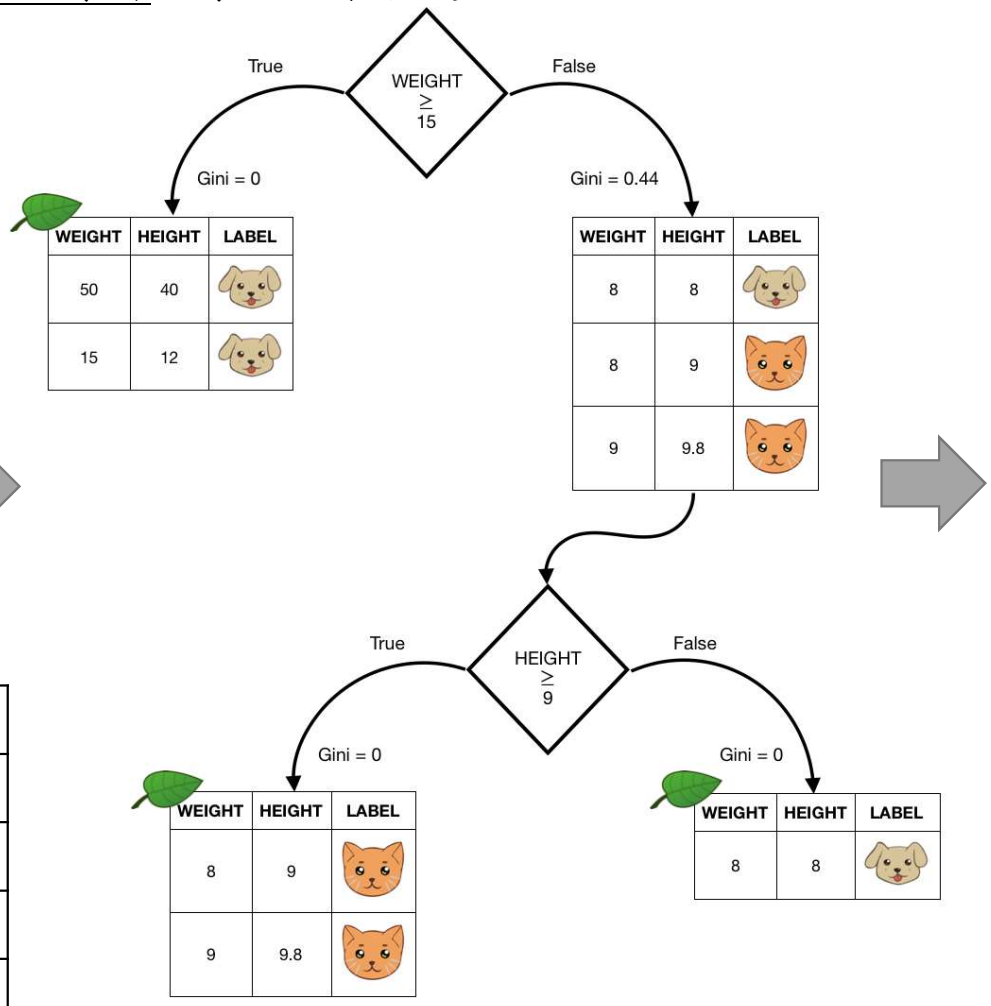
資料結構化:

身高
體重
性別
毛髮顏色
花紋有無
叫聲
鼻子形狀
:
飼養者每月平均花費
每年上動物醫院院次數
每年上動物美容院次數

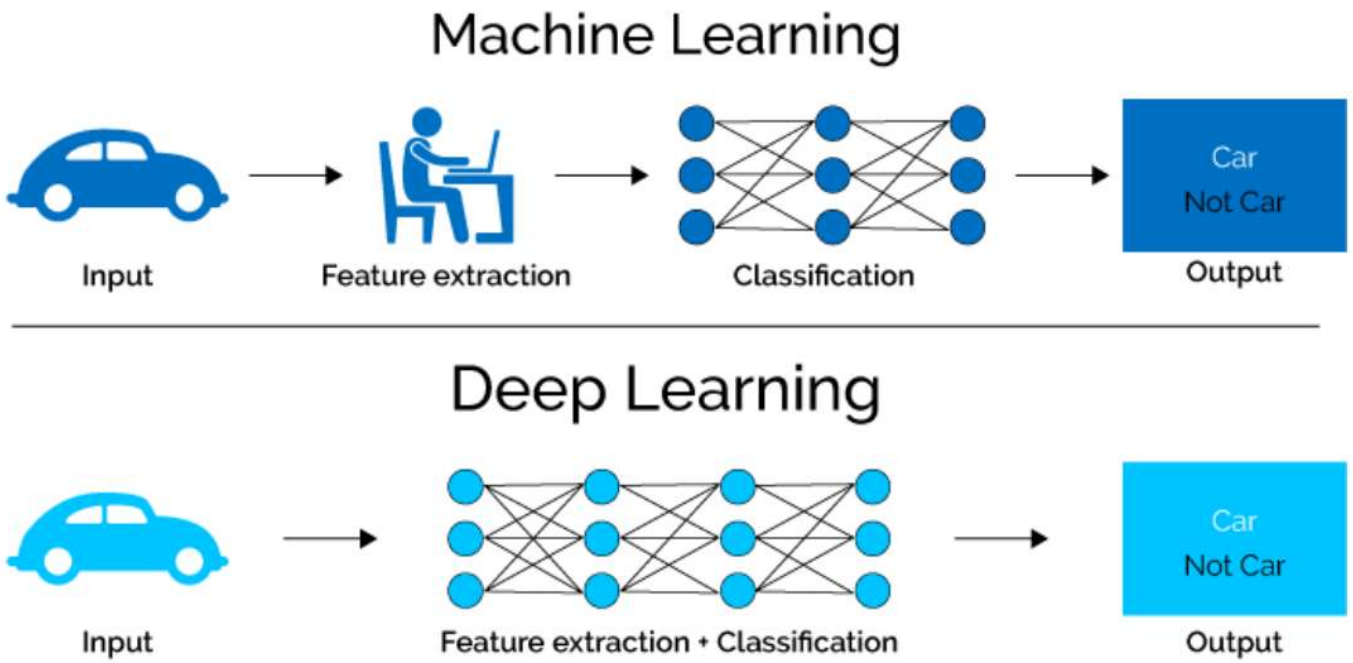


特徵提取
(feature extraction) :
選入幫助模型進行決策(提高分類/預測準確度)的變項

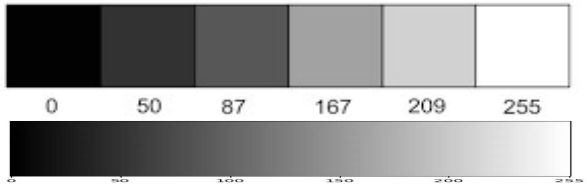
ID	H	W	label
001	8	8	DOG
002	40	50	DOG
:			
999	9	8	CAT

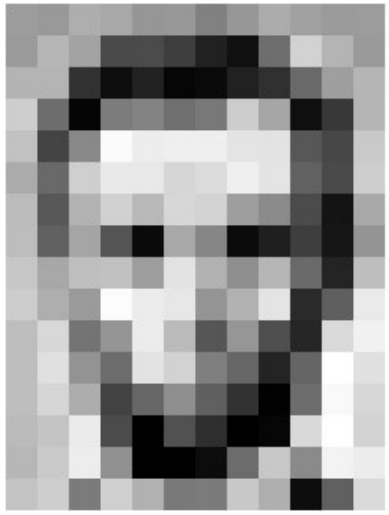


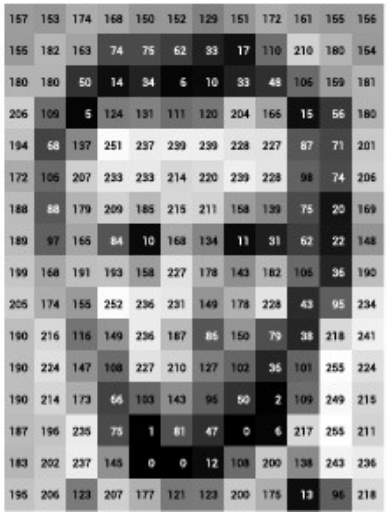
深度學習(Deep Learning)



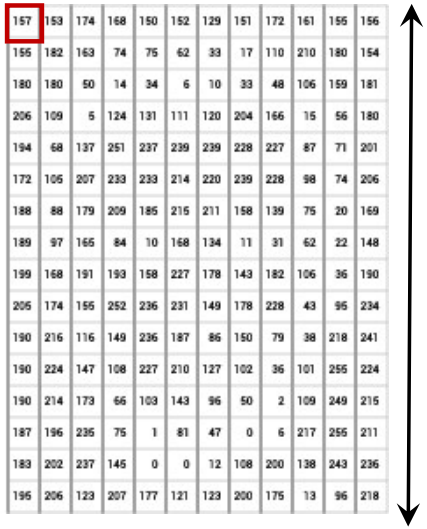
電腦看到什麼 - 電腦視覺（Computer vision）



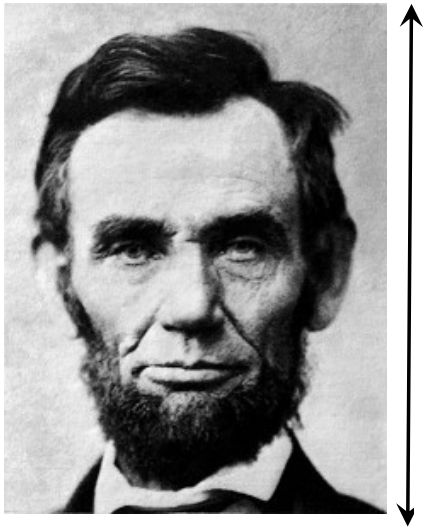




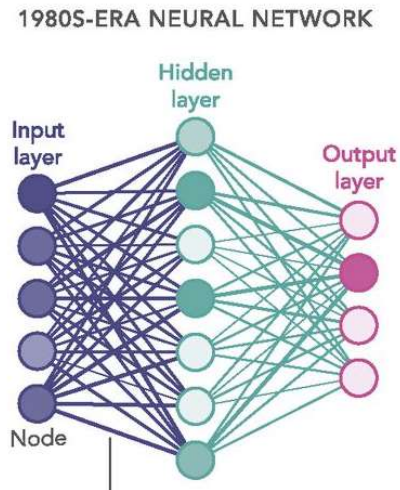
1個像素 (pixel)

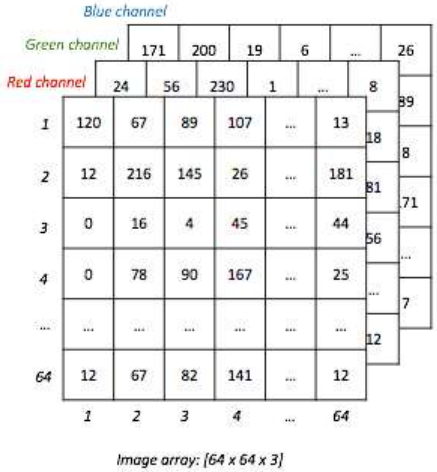


12 X 17 像素 (pixel)



224 X 300 像素 (pixel)





亞伯拉罕·林肯，第十六任美國總統

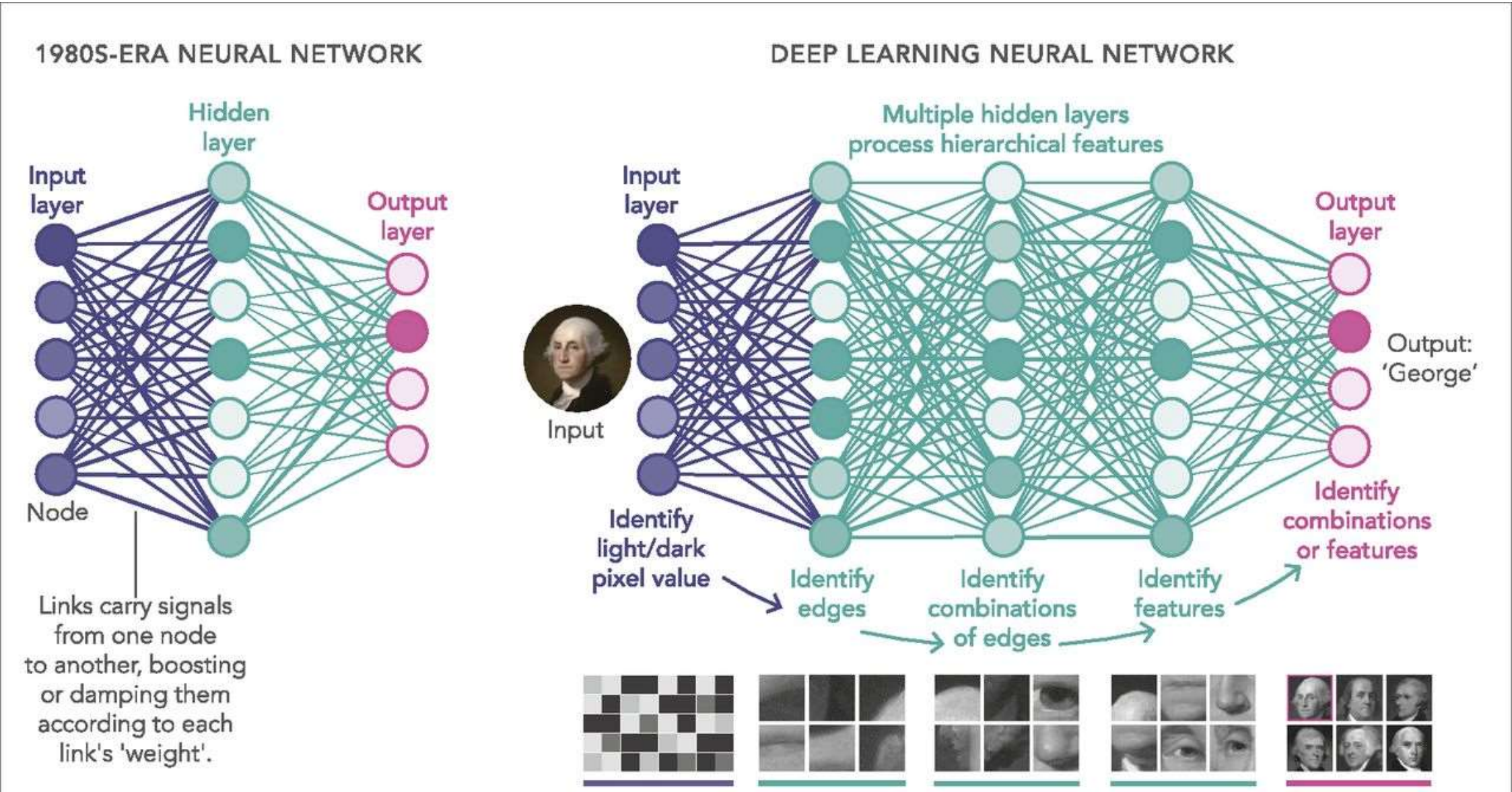
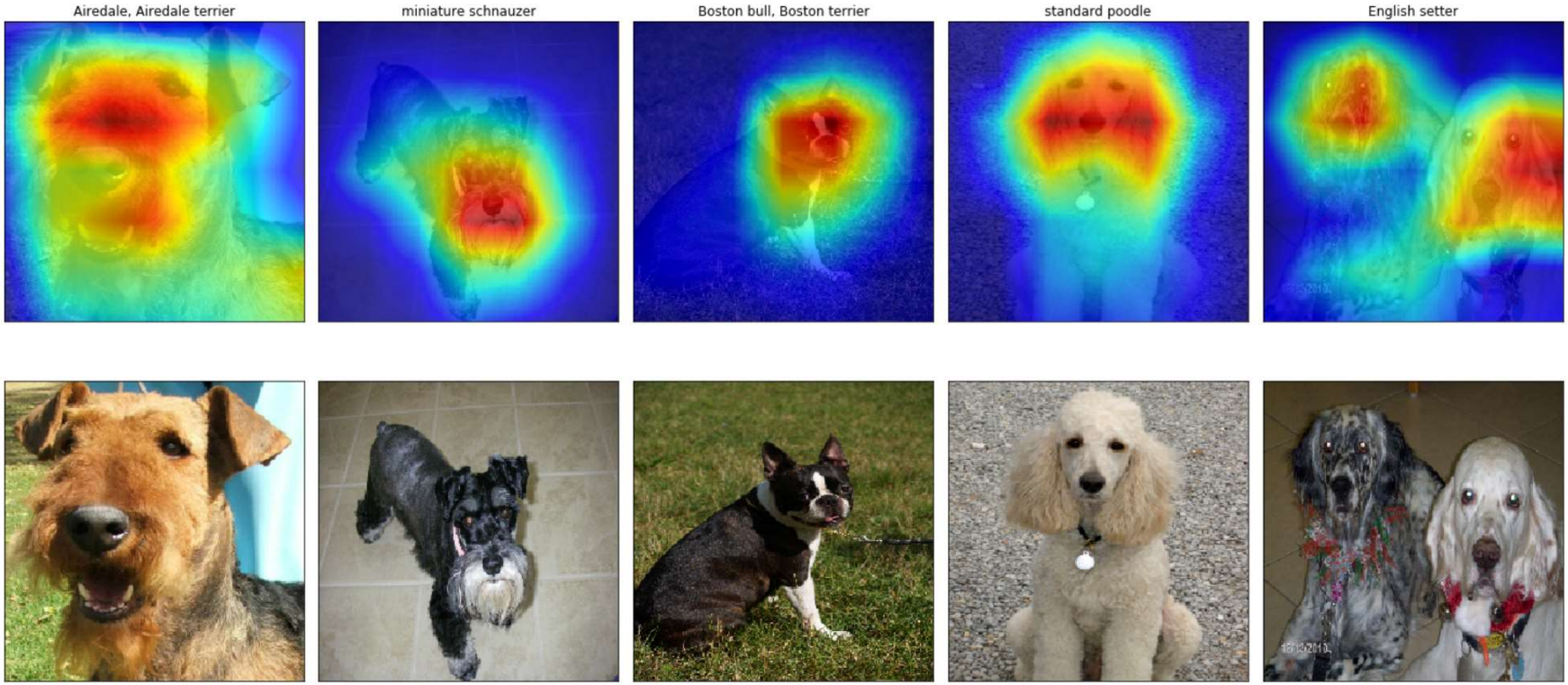


Image recognition: Pixel → edge → texton → motif → part →object



萬能㹴
(Airedale Terrier)

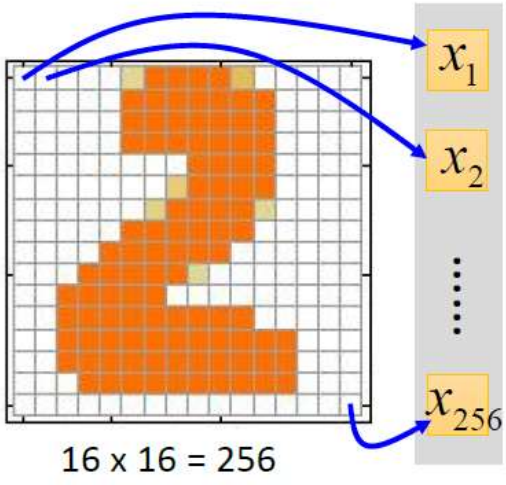
迷你雪納瑞
(Miniature Schnauzer)

波士頓㹴
(Boston Terrier)

標準貴賓犬
(Standard Poodle)

英國蹲獵犬
(English Setter)

Input



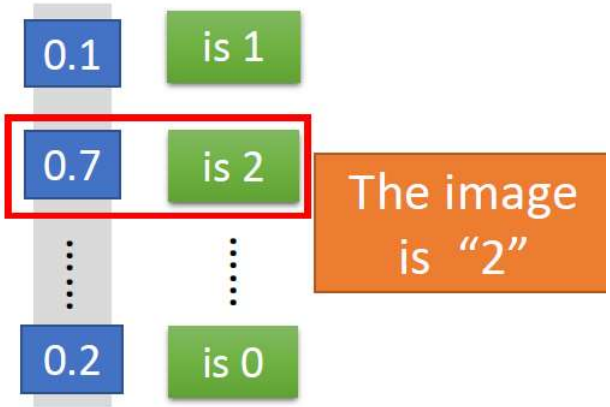
Ink → 1

No ink → 0

Neural Network

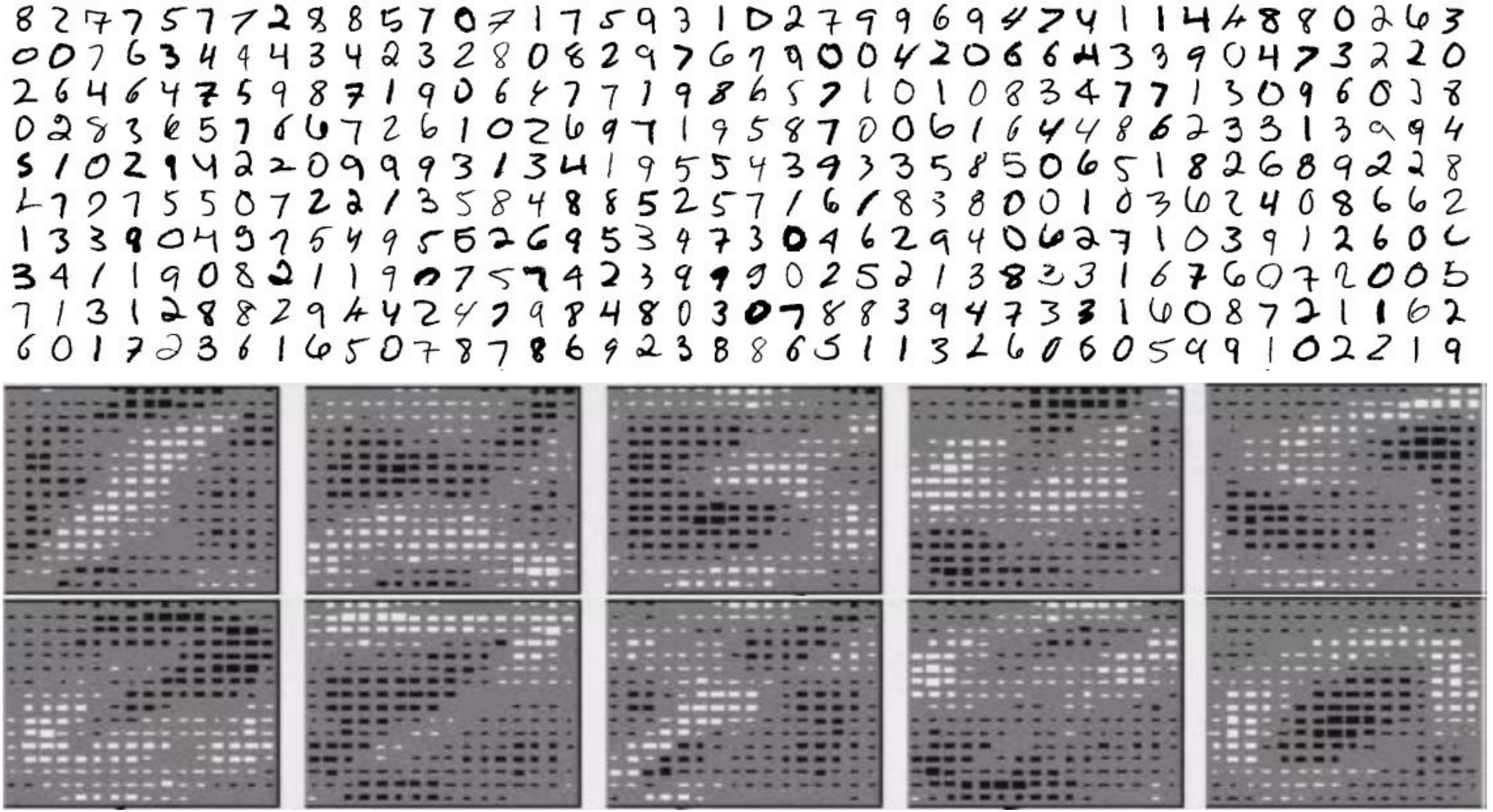
What is needed is a function .....

Output



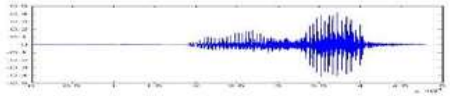
Each dimension represents the confidence of a digit.

深度學習 學到什麼?



Deep learning can be highly flexible

- Speech Recognition

$f^*($  $) =$ "Morning"

- Handwritten Recognition

$f^*($  $) =$ "2"

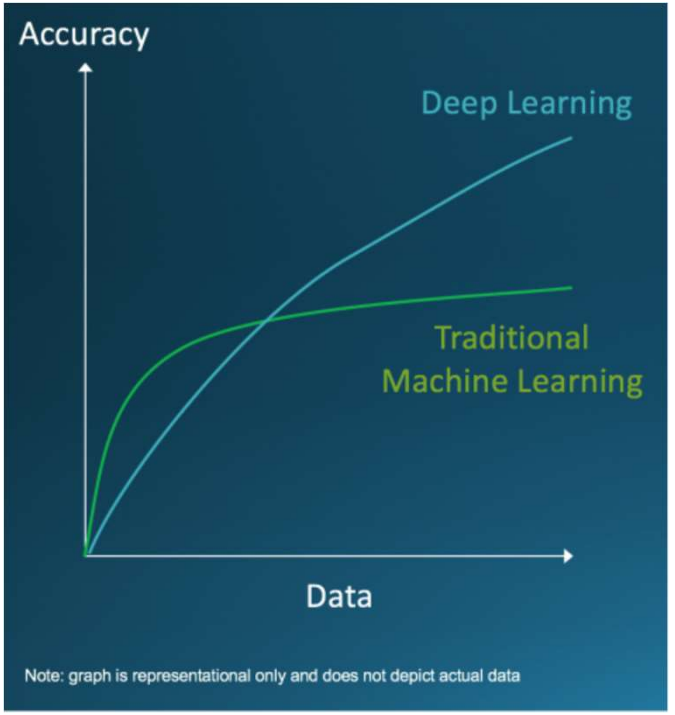
- Playing Go

$f^*($  $) =$ "5-5" (step)

- Dialogue System

$f^*($ "Hi" $) =$ "Hello"

(what the user said) (system response)



吉娃娃 OR 瑪芬

New tool + Big data → New finding

America's favorite pies

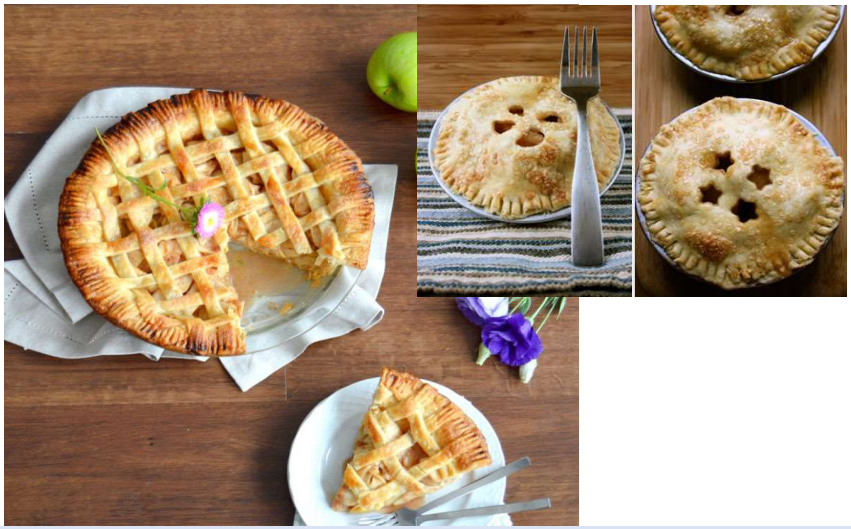
南瓜派

胡桃派

檸檬派 (ley lime pie)

蘋果派

櫻桃派



More data → New finding

定位紀錄, 心跳, 心電圖

汽車防盜系統

斐斯托斯圓盤
Phaistos Disc

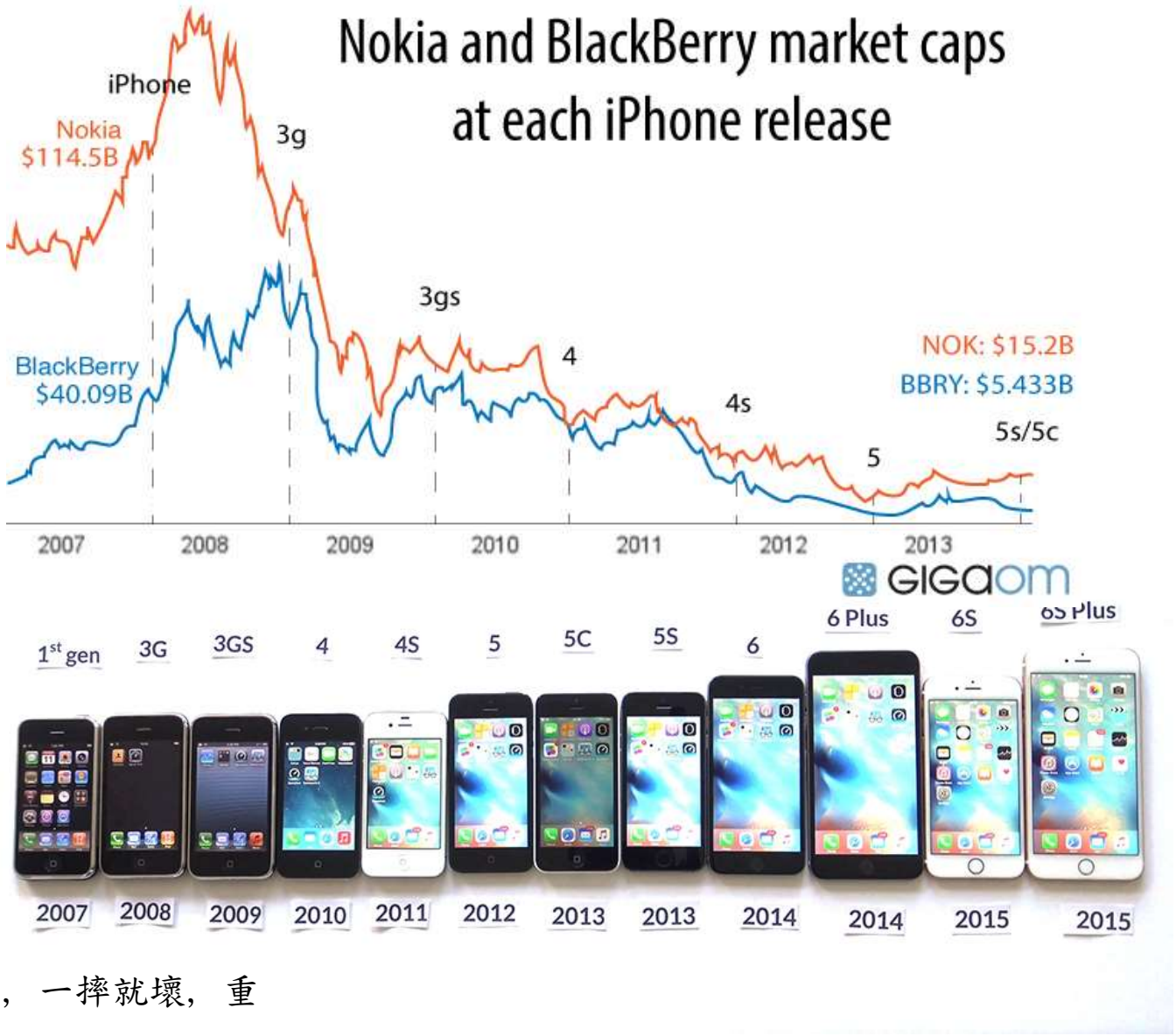
5D optical data storage
360TB, 189 ˚C 保存138億年

More data → better finding ?

王聖捷
Tricia Wang

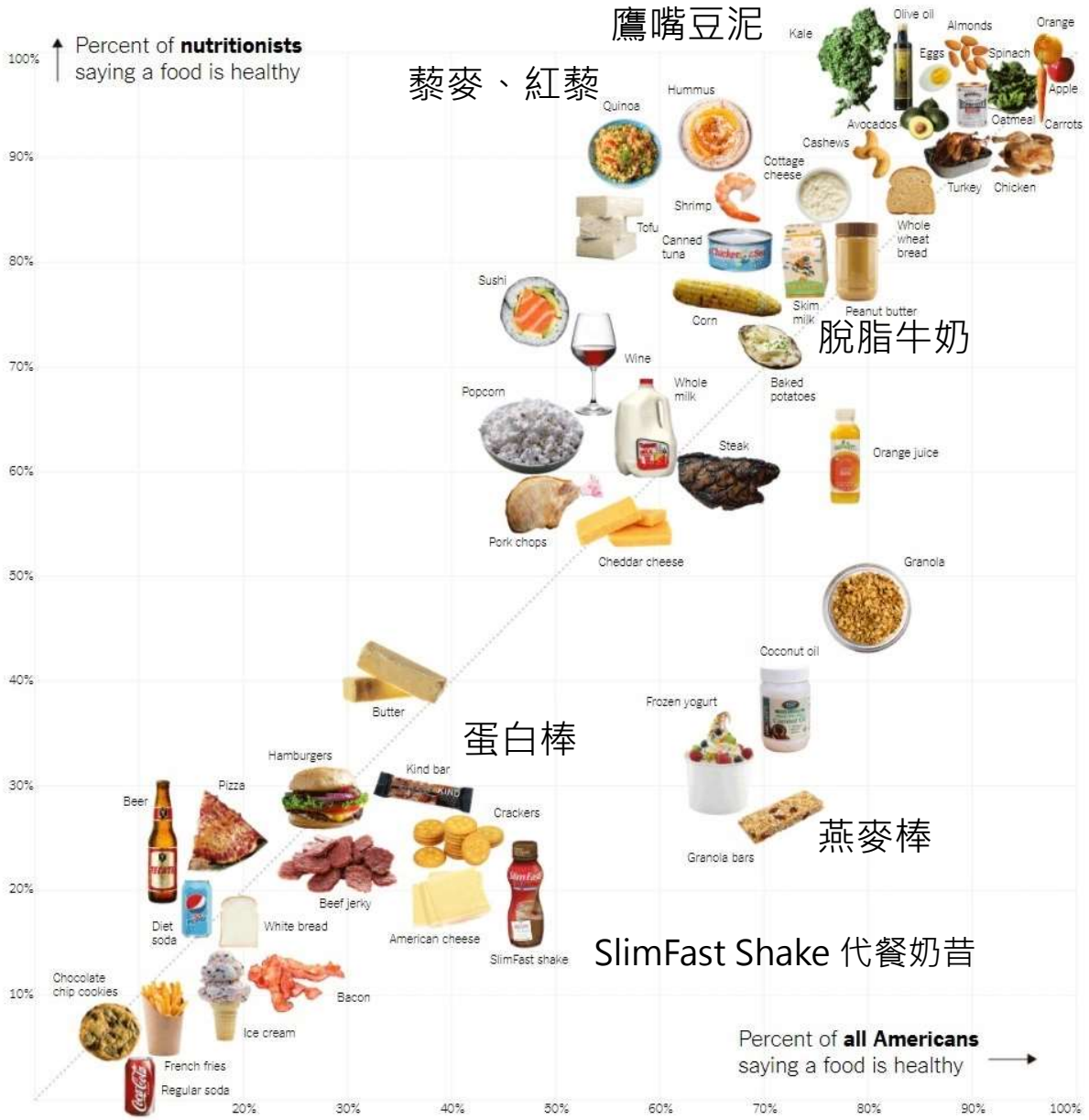
- 知道智慧型手機的族群
- 不知道智慧型手機的族群

NOKIA



貴，一摔就壞，重

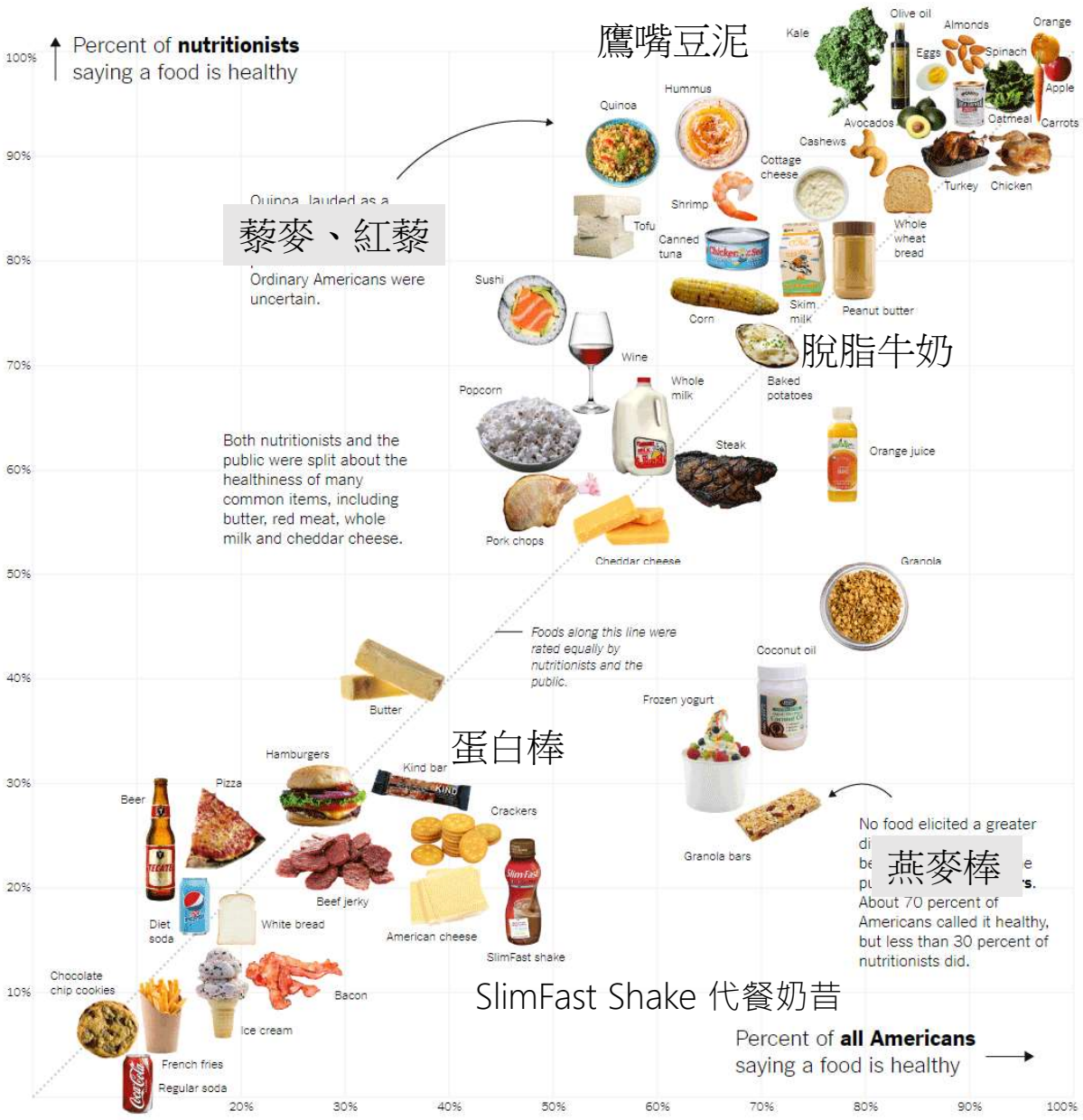
Know your data
know your question



Ref: NYTimes.com

https://www.nytimes.com/interactive/2016/07/05/upshot/is-sushi-healthy-what-about-granola-where-americans-and-nutritionists-disagree.html#:~:text=No%20food%20elicited%20a%20greater,30%20percent%20of%20nutritionists%20did.

American Society for Nutrition
www.nutrition.org



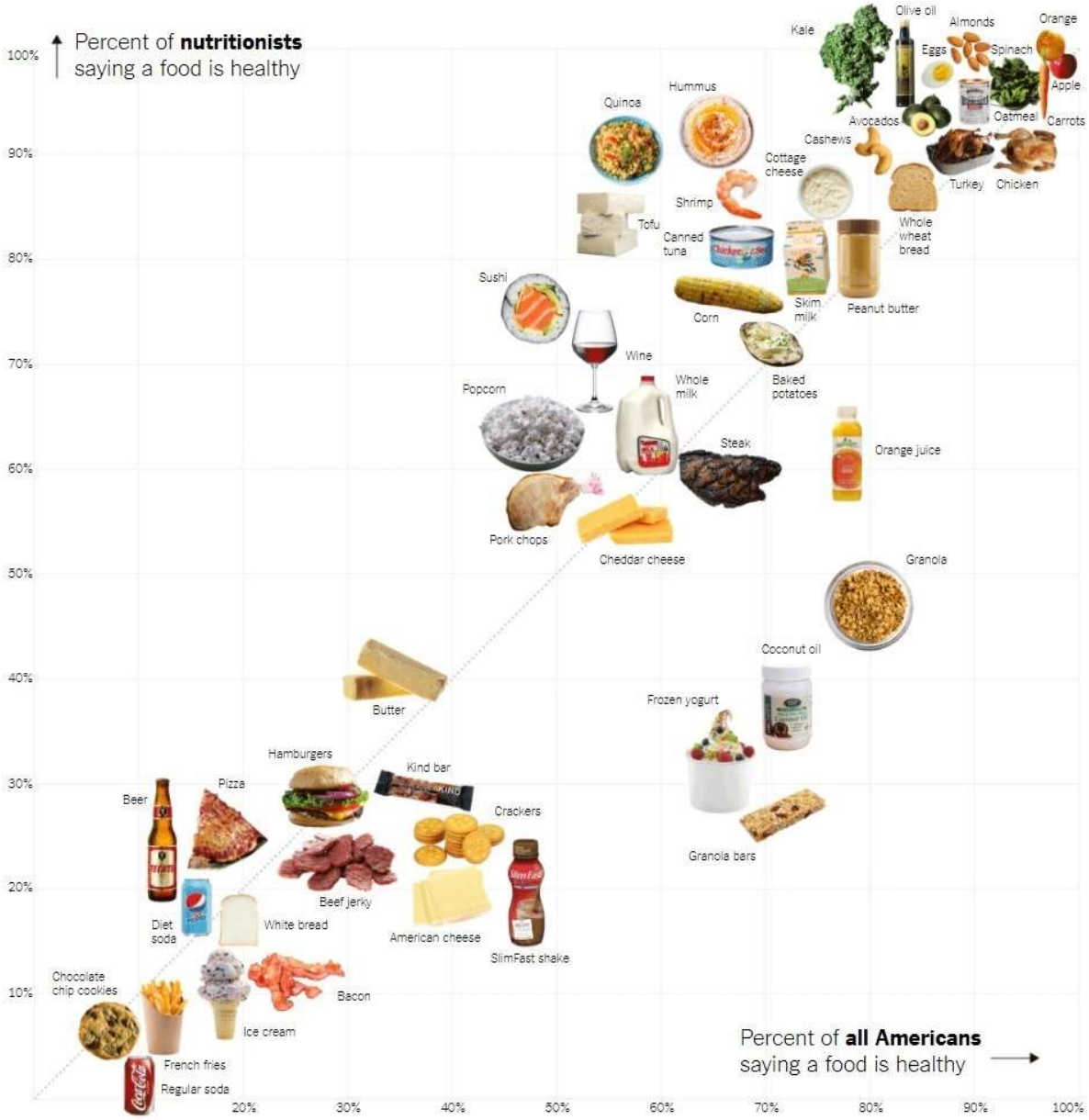
Variables:

- Percentage o f **nutritionists** saying a food is healthy.
- Percentage o f **all Americans** saying a food is healthy.
- Food

Ref: NYTimes.com

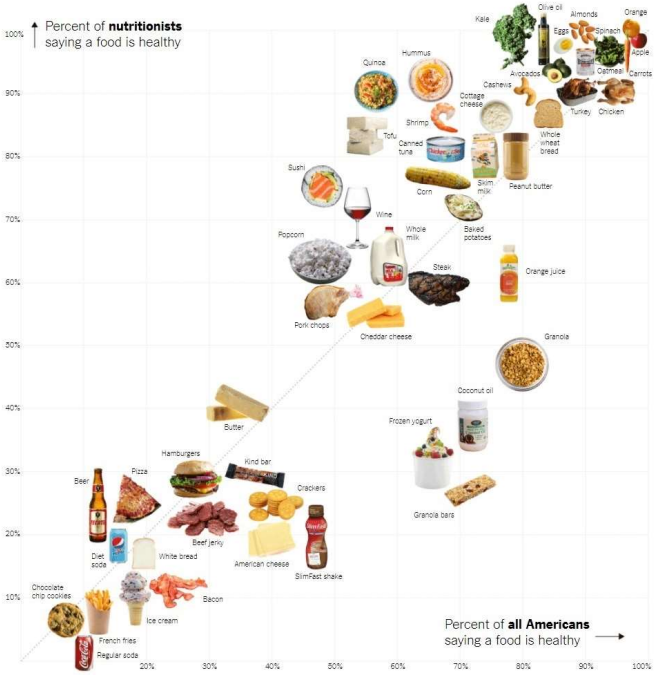
https://www.nytimes.com/interactive/2016/07/05/upshot/is-sushi-healthy-what-about-granola-where-americans-and-nutritionists-disagree.html#:~:text=No%20food%20elicited%20a%20greater,30%20percent%20of%20nutritionists%20did.

- What do you **notice**?
- What do you **wonder**?
- What kind of **headline** would you write for this graph?



Ref: NYTimes.com

https://www.nytimes.com/interactive/2016/07/05/upshot/is-sushi-healthy-what-about-granola-where-americans-and-nutritionists-disagree.html#:~:text=No%20food%20elicited%20a%20greater,30%20percent%20of%20nutritionists%20did.



Foods considered healthier by the public than by experts

Percent describing a food as "healthy"	Nutritionists	Public	Difference
Granola bar	28%	71%	43
Coconut oil	37%	72%	35
Frozen yogurt	32%	66%	34
Granola	47%	80%	33
SlimFast shake	21%	47%	26
Orange juice	62%	78%	16
American cheese	24%	39%	15

SlimFast Shake 代餐奶昔: 4克脂肪，1克飽和脂肪，30克碳水化合物，4克纖維，22克糖，10克蛋白質

BBC中文網

BBC試驗：椰子油是超級食品還是心臟病殺手？

許多科學家都對椰子油的健康療效持懷疑態度。 不僅如此，科學界還把椰子油看作是壞脂肪，因為它富含飽和脂肪（86%），遠遠高 ...

Jan 9. 2018

TVBS新聞

椰子油是好油還是毒藥？國健署闢謠，預防失智多運動、多動腦較實在

網傳椰子油對身體很好，但也有人說是毒藥，到底哪個才正確？國健署指出，椰子油有90%是飽和脂肪酸，吃太多容易造成心血管疾病風險，民眾

Cosmopolitan HK

椰子油8大美容功效：抗衰老、美白牙齒、護髮、排毒....女星們 ...

椰子油其實是從椰果肉中提煉出來的油脂，當中含有豐富的月桂酸（lauric acid），它是一種 ...

Oriental Sunday More

油拔法：用椰子油漱口可排毒、美白牙齒！天后鄭秀文和容祖兒 ...

椰子油漱口又稱「油拔法」（英文：oil pulling），是一種源自古印度阿育吠陀(Ayurveda) 的天然療法，一直流傳至今。到90年代初，由一位名 ...

2 weeks ago

從建立資料整理邏輯開始
打好精準醫學研究根基

Drive progress Precision Medicine 2030

Genome Sequencing and Big Data in Health Care
Health Care Database and Data Standardization
Health Industry Development

MEDTECH

—未來城市FUTURECITY • 智慧醫療—

#2 我們的未來醫生

未來競爭力

不在醫院的大小，而是資料的完整性跟正確性。

北醫院長

陳瑞杰

Garbage In Garbage Out

Open access, freely available online

Essay

Why Most Published Research Findings Are False John P. A. Ioannidis, PLoS Med. **2005** Aug

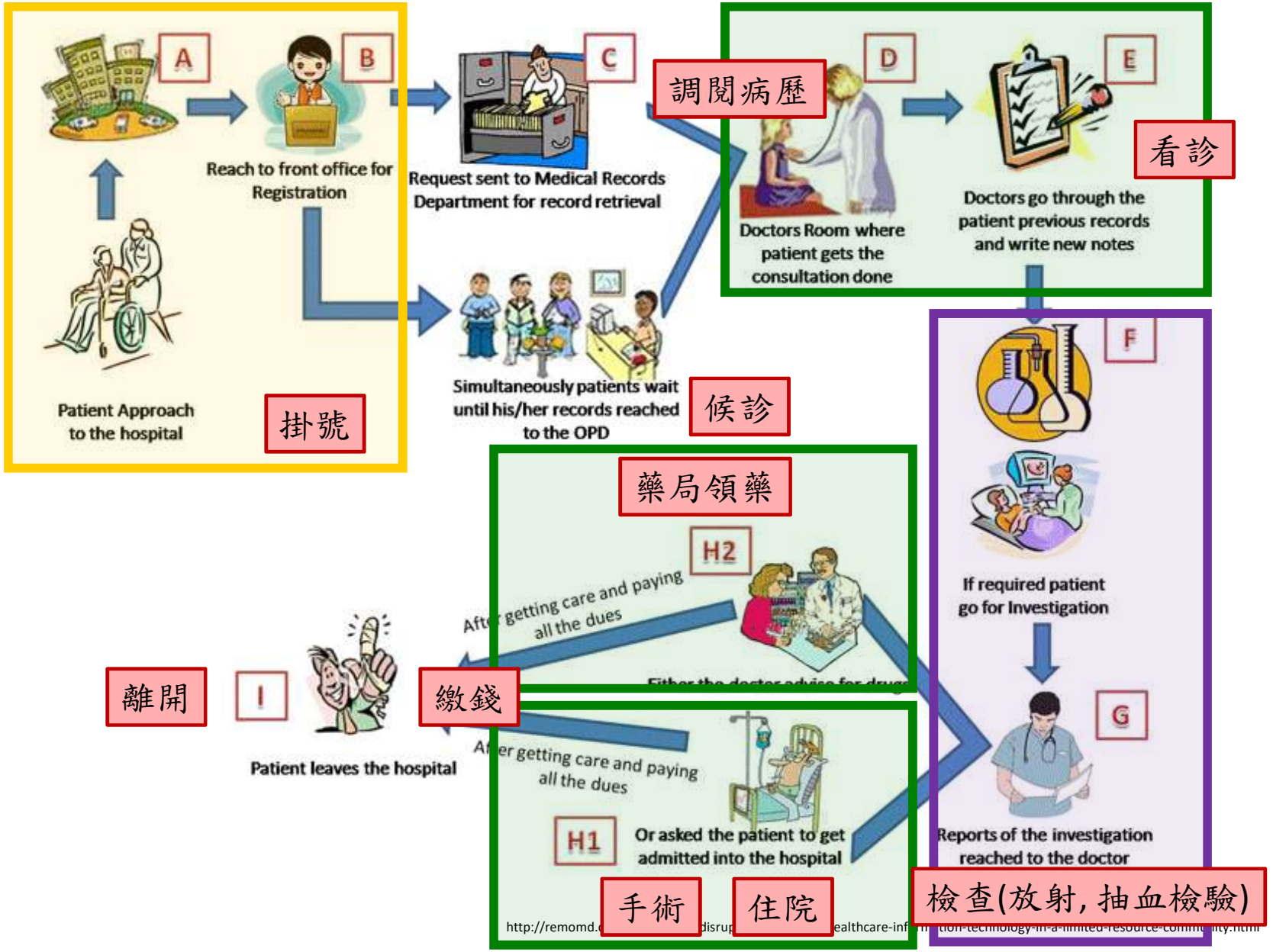
John P. A. Ioannidis

醫學假設 ✔→ 實驗證實 ?→ 現實生活

BAYER ?→

DATA → Model → Result

就醫流程


A
B
C
D
E
F
G
H2
H1
I
Patient Approach to the hospital
掛號
Reach to front office for Registration
Request sent to Medical Records Department for record retrieval
調閱病歷
Doctors Room where patient gets the consultation done
Doctors go through the patient previous records and write new notes
看診
Simultaneously patients wait until his/her records reached to the OPD
候診
If required patient go for Investigation
Reports of the investigation reached to the doctor
檢查(放射, 抽血檢驗)
藥局領藥
After getting care and paying all the dues
繳錢
Or asked the patient to get admitted into the hospital
手術
住院
Patient leaves the hospital
離開

入院護理紀錄

病歷號	年齡	性別	婚姻狀況	教育程度
1234567	60	男	鰥寡	小學
1234578	64	男	新婚	10年
2546871	99	女	已婚	大專以上

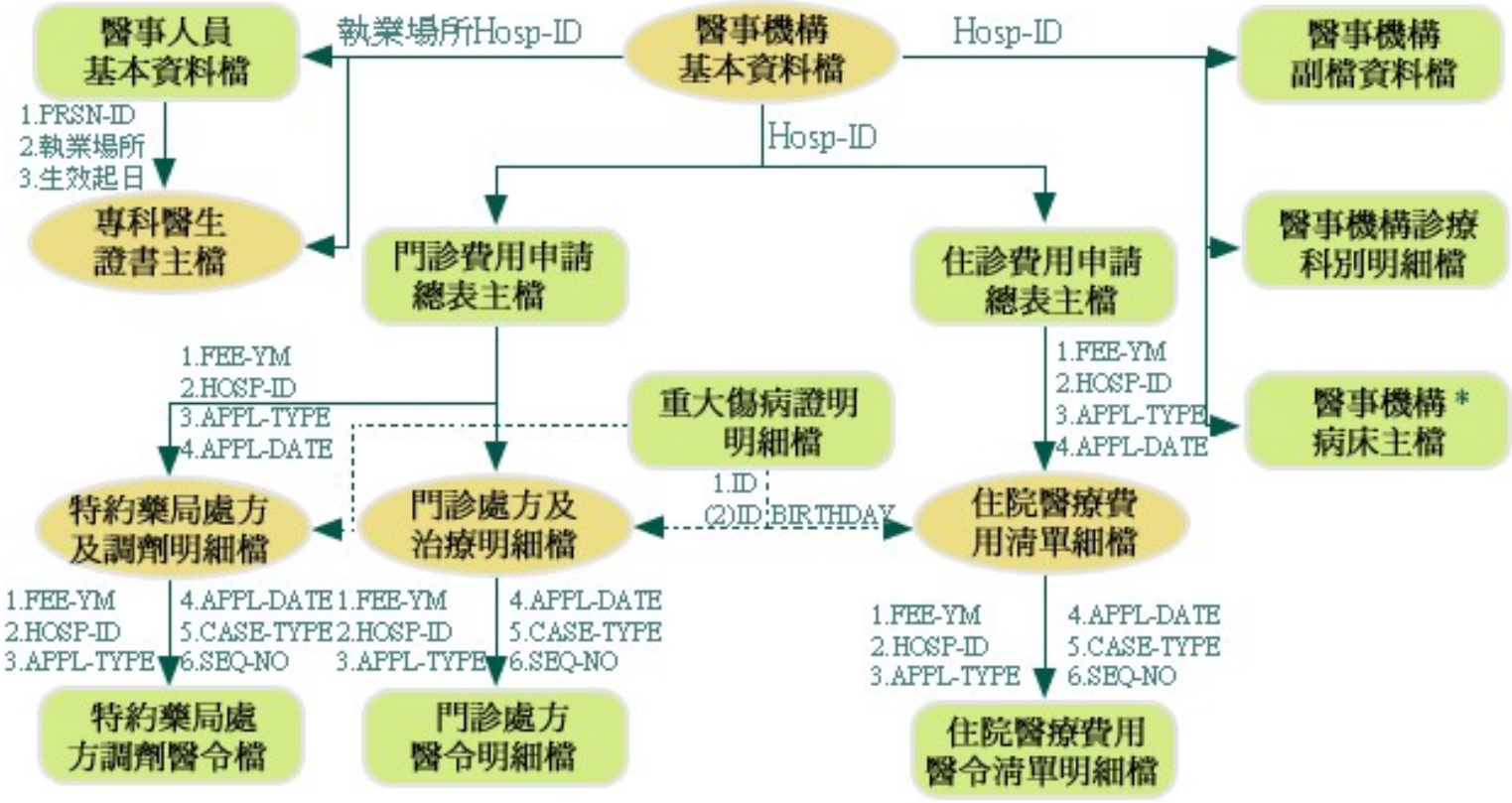
入院醫生診斷

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	診斷碼1	診斷碼2	診斷碼3	診斷碼4
1	1234567	2020/06/12	1960/05/01	高血壓	腦血管疾病	心臟疾病	子宮頸惡性腫瘤
2	1234578	2020/06/31	1955/11/24	高血壓	糖尿病	氣喘	
3	2546871	2020/07/01	2008/02/09	糖尿病	心臟疾病		

入院醫生處置

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	藥碼1	藥碼2	藥碼3	藥碼4
1	1234567	2020/06/12	1960/05/01	B01	B05	B05	A03
2	1234578	2020/06/31	1955/11/24	A03	B05	A04	M04
3	2546871	2020/07/01	2008/02/09	A03	M04	A04	R06

各檔案間串檔變項說明



註:*須注意生效起訖日期

(2)可由ID+BIRTHDAY串檔

→ 各檔案間由所註明變項串檔可獲得對應資訊

→ 各檔案間可由所註明變項串檔,但未必獲得對應資料

變項類型

- **連續[量]: 小數點有意義的數字**

Ex.,血清總膽固醇濃度(mg / dl), 溫度(攝氏), BMI(kg/m^2)...

- **序數: 有順序上的關係,但沒有數學上倍數的關係**

Ex.,[冠軍, 亞軍, 季軍] [低年級, 中年級, 高年級] 疼痛指數

滿意度[很滿意, 滿意, 尚可, 不滿意, 很不滿意]

- **類別[質]: 沒有大小關係**

  二項: 只有兩個類別

  Ex., [死亡/存活] [男/女][有/沒有 糖尿病]
  [有/沒有 抽菸]

  非二項: 兩個以上類別

  Ex., 血型[A型, B型, AB型, O型]
  種族[高加索人, 非洲人, 亞洲人]

- **時間(天)** – 開始治療後到死亡, 診斷後到復發 ....

資料整理

資料整理

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	年齡	性別	婚姻狀況	教育程度	診斷碼1	診斷碼2	診斷碼3	診斷碼4
1	1234567	2020/06/12	1960/05/01	60	男	鰥寡	小學	高血壓	腦血管疾病	心臟疾病	子宮頸惡性腫瘤
2	1234578	2020/06/31	1955/11/24	64	男	新婚	10年	高血壓	糖尿病	氣喘	
3	2546871	2020/07/01	2008/02/09	99	女	已婚	大專以上	糖尿病	心臟疾病		

1. 數值是否符合一般(醫學)認知?

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	年齡	性別	婚姻狀況	教育程度	診斷碼1	診斷碼2	診斷碼3	診斷碼4
1	1234567	2020/06/12	1960/05/01	60	男	鰥寡	小學	高血壓	腦血管疾病	心臟疾病	子宮頸惡性腫瘤
2	1234578	2020/06/31	1955/11/24	64	男	新婚	10年	高血壓	糖尿病	氣喘	
3	2546871	2020/07/01	2008/02/09	32	女	已婚	大專以上	糖尿病	心臟疾病		

12?

未婚	小學
已婚	國中
鰥寡	高中
離婚	大專以上
其他	其他

資料整理

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	年齡	性別	婚姻狀況	教育程度	診斷碼1	診斷碼2	診斷碼3	診斷碼4
1	1234567	2020/06/12	1960/05/01	60	男	鰥寡	小學	高血壓	腦血管疾病	心臟疾病	子宮頸惡性腫瘤
2	1234578	2020/06/31	1955/11/24	64	男	新婚	10年	高血壓	糖尿病	氣喘	
3	2546871	2020/07/01	2008/02/09	32	女	已婚	大專以上	糖尿病	心臟疾病		

Raw data

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	年齡	性別	婚姻狀況	教育程度	診斷碼1	診斷碼2	診斷碼3	診斷碼4
1	1234567	2020/06/12	1960/05/01	60	男	鰥寡	小學	高血壓	腦血管疾病	心臟疾病	~~子宮頸惡性腫瘤~~
2	1234578	2020/06/31	1955/11/24	64	男	已婚	國中	高血壓	糖尿病	氣喘	
3	2546871	2020/07/01	1988/02/09	32	女	已婚	大專以上	糖尿病	心臟疾病		

Step 1 除錯

資料整理

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	年齡	性別	婚姻狀況	教育程度	診斷碼1	診斷碼2	診斷碼3	診斷碼4
1	1234567	2020/06/12	1960/05/01	60	男	鰥寡	小學	高血壓	腦血管疾病	心臟疾病	
2	1234578	2020/06/31	1955/11/24	64	男	已婚	國中	高血壓	糖尿病	氣喘	
3	2546871	2020/07/01	1988/02/09	32	女	已婚	大專以上	糖尿病	心臟疾病		

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	年齡	性別	婚姻狀況	教育程度	高血壓	腦血管疾病	糖尿病	心臟疾病	氣喘
1	1234567	2020/06/12	1960/05/01	60	男	鰥寡	小學	1	1	0	1	0
2	1234578	2020/06/31	1955/11/24	64	男	已婚	國中	1	0	1	0	1
3	2546871	2020/07/01	1988/02/09	32	女	已婚	大專以上	0	0	1	1	0

Step2 : 整理架構

資料整理

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	年齡	性別	婚姻狀況	教育程度	診斷碼1	診斷碼2	診斷碼3	診斷碼
1	1234567	2020/06/12	1960/05/01	60	男	鰥寡	小學	高血壓	腦血管疾病	心臟疾病	
2	1234578	2020/06/31	1955/11/24	64	男	已婚	國中	高血壓	糖尿病	氣喘	
3	2546871	2020/07/01	1988/02/09	32	女	已婚	大專以上	糖尿病	心臟疾病		

床號	病歷號	住院日 (yyyy/mm/dd)	出生年月日 (yyyy/mm/dd)	年齡	性別	婚姻狀況	教育程度	高血壓	腦血管疾病	糖尿病	心臟疾病	氣喘
1	1234567	2020/06/12	1960/05/01	60	1	3	1	1	1	0	1	0
2	1234578	2020/06/31	1955/11/24	64	1	2	2	1	0	1	0	1
3	2546871	2020/07/01	1988/02/09	32	2	2	4	0	0	1	1	0

Step3 : coding book

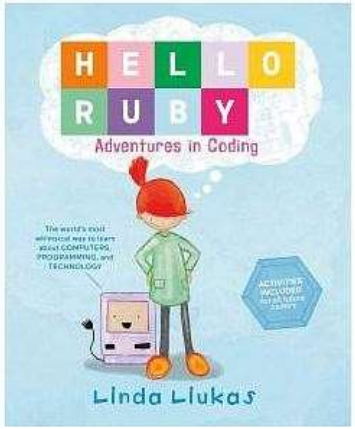
1,男
2,女

1,未婚
2,已婚
3,鰥寡
4,離婚
5,其他

1,小學
2,國中
3,高中
4,大專以上
5,其他

0,無
1,有

資料結構邏輯



露比任務：培養孩子邏輯思考的程式尋寶記

字串、數字、布林值(booleans)

字串：只要能被包括在引號裡的符號都算是字串, 他可能包含了字母、數字、空白, 或是其他電腦鍵打得出來的符號, 像是”Ruby”.

數字：像是1、2、3, 或是 4.1217.

布林值(booleans)：他只有「真」(True) 或是「假」(False)兩種表達方式

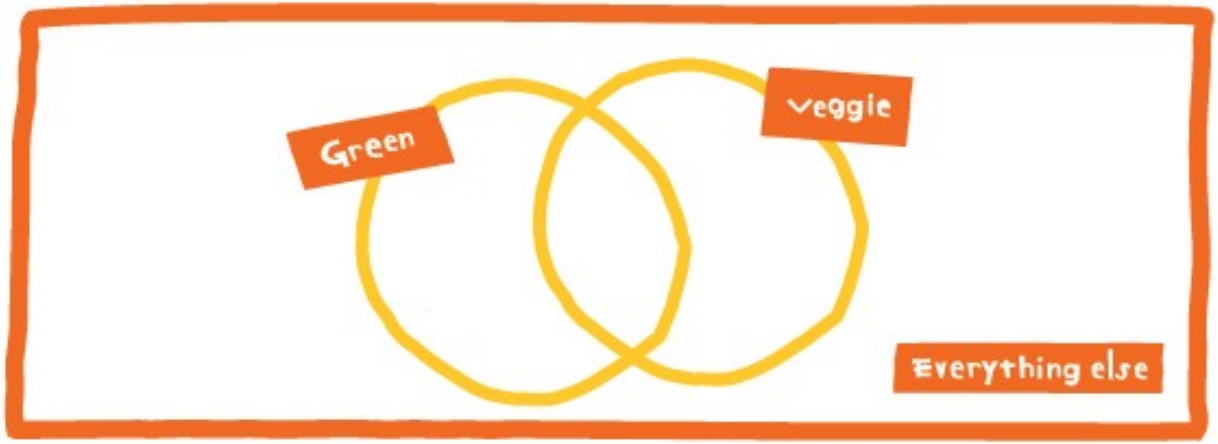
I'm red and yellow. True/False
I'm pink and green. True/False
I'm happy. True/False

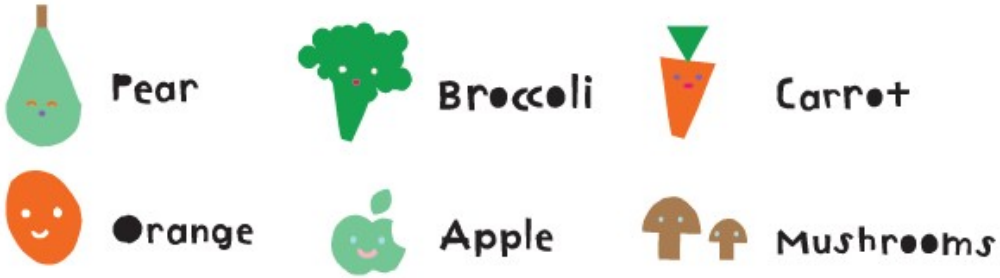
My eyes are green. True/False
I have six points. True/False
I am not yellow. True/False

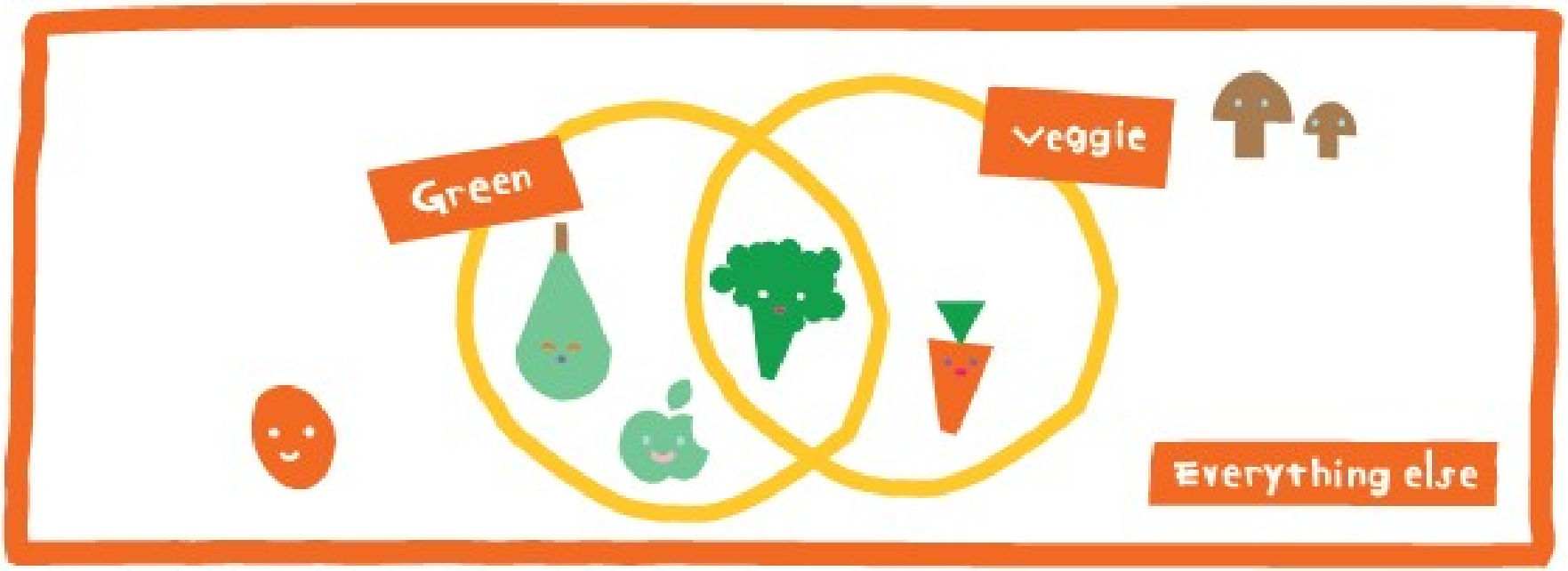
I have legs. True/False
I have arms and legs. True/False
I have arms or legs. True/False

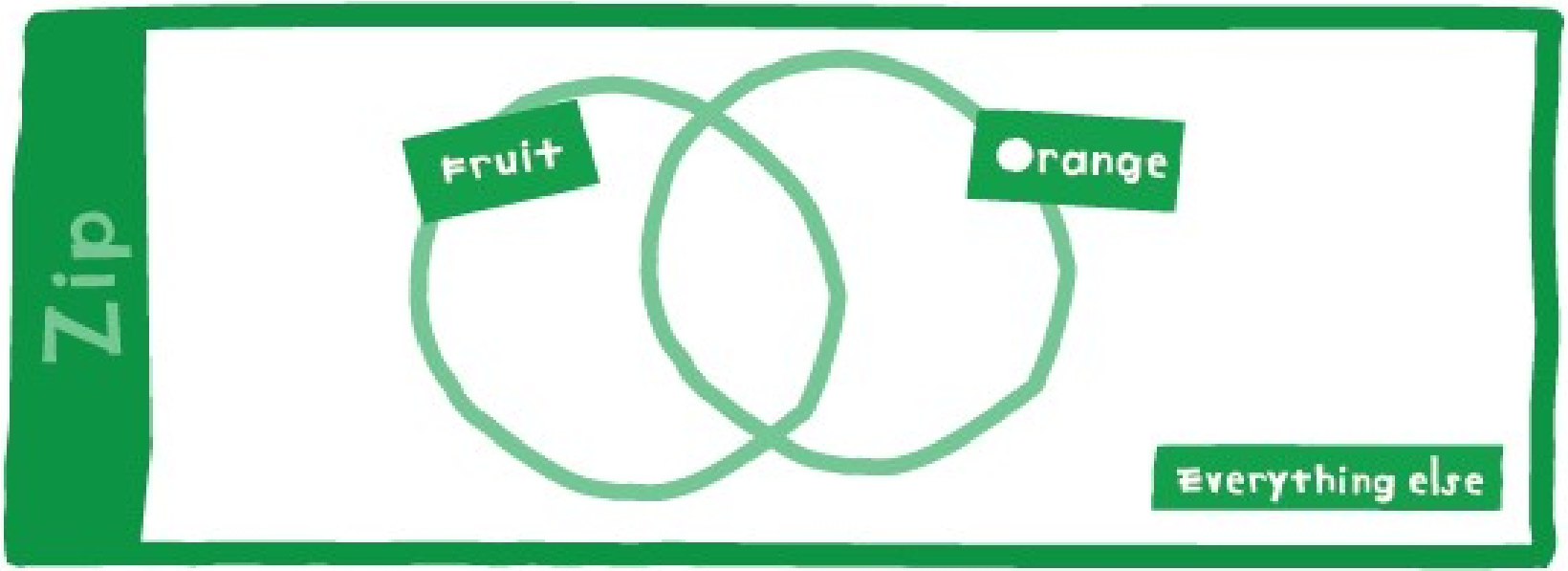
資料結構 (data structure)

資料結構 (data structure) : 資料有許多型態. 像是字串、數字與布林值.當手上有非常多資料時, 把他們排列的有條有理, 會大大的提升使用效率. 我們將這個方法稱之為「資料結構」 (data structure).






Green
Veggie
Everything else



Pear

Broccoli

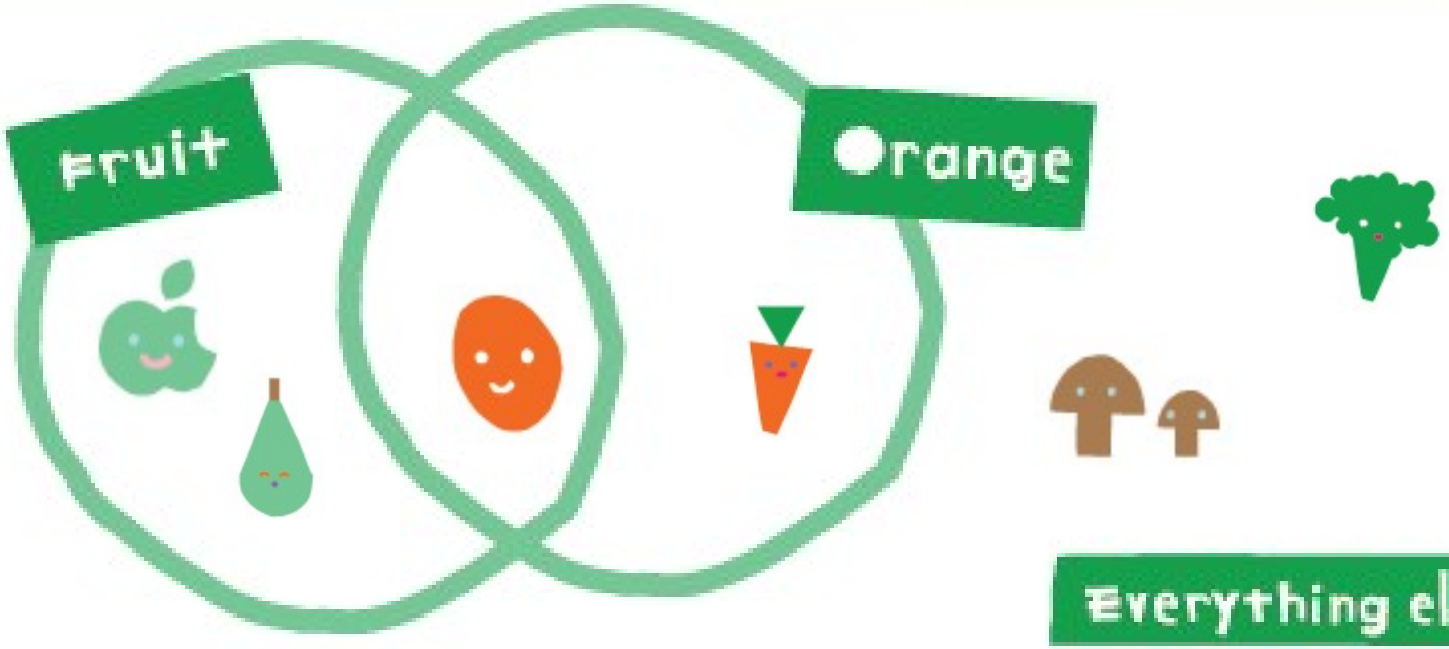
Carrot

Orange

Apple

Mushrooms

Zip



	水果	橘色
1 		
2 		
3 		
4 		
5 		
6 		

	水果	橘色
1 	+	-
2 	-	-
3 	-	+
4 	+	+
5 	+	-
6 	-	-

True / False

	水果	橘色	水果且橘色
1 	+	-	
2 	-	-	
3 	-	+	
4 	+	+	
5 	+	-	
6 	-	-	

True / False

	水果	橘色	水果且橘色
1 	+	-	**False**
2 	-	-	**False**
3 	-	+	**False**
4 	+	+	**True**
5 	+	-	**False**
6 	-	-	**False**

True / False

	水果	橘色	水果 或 橘色
1 	+	-	
2 	-	-	
3 	-	+	
4 	+	+	
5 	+	-	
6 	-	-	

True / False

	水果	橘色	水果 或 橘色
1 	+	-	**True**
2 	-	-	**False**
3 	-	+	**True**
4 	+	+	**True**
5 	+	-	**True**
6 	-	-	**False**

True / False

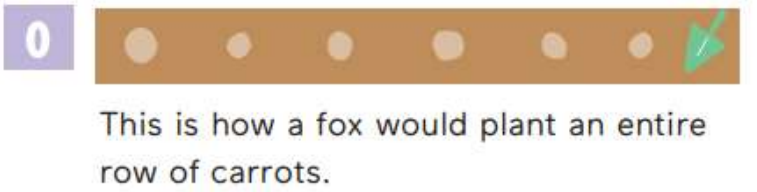
	水果	橘色	水果 且 不是橘色
1 	+	-	
2 	-	-	
3 	-	+	
4 	+	+	
5 	+	-	
6 	-	-	

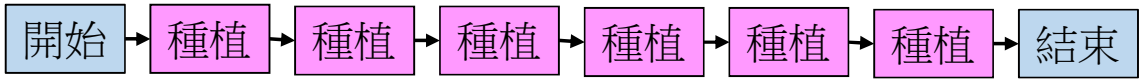
True / False

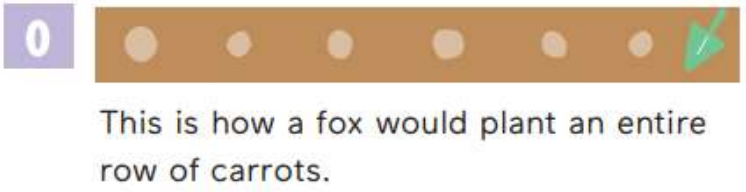
	水果	橘色	水果 且 不是橘色
1 	+	-	**True**
2 	-	-	**False**
3 	-	+	**False**
4 	+	+	**False**
5 	+	-	**True**
6 	-	-	**False**

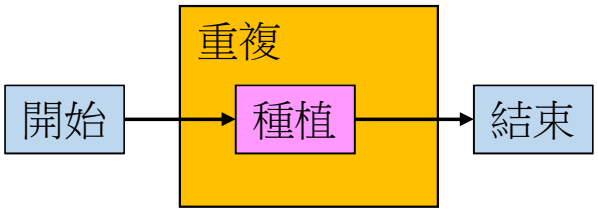
			True / False	True / False	True / False
	水果	橘色	水果 且 橘色	水果 或 橘色	水果 且 不是橘色
1 	+	-	**False**	**True**	**True**
2 	-	-	**False**	**False**	**False**
3 	-	+	**False**	**True**	**False**
4 	+	+	**True**	**True**	**False**
5 	+	-	**False**	**True**	**True**
6 	-	-	**False**	**False**	**False**

迴圈 (loop)


0
This is how a fox would plant an entire row of carrots.


開始
種植
種植
種植
種植
種植
種植
結束


0
This is how a fox would plant an entire row of carrots.

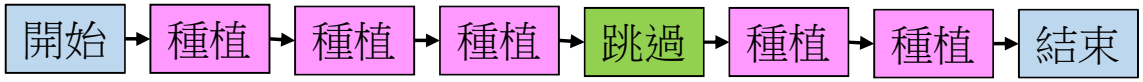

重複
開始
種植
結束

選擇

「如果...,就...」(if-then)

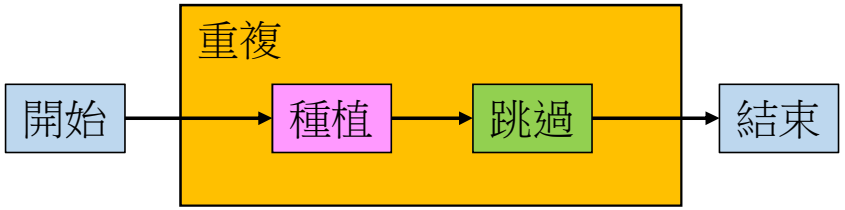
2

One piece of instruction has gone missing. Can you figure out which one?



3

The foxes came up with a shorter way to write the instructions. Can you help them fill in the code?



選擇

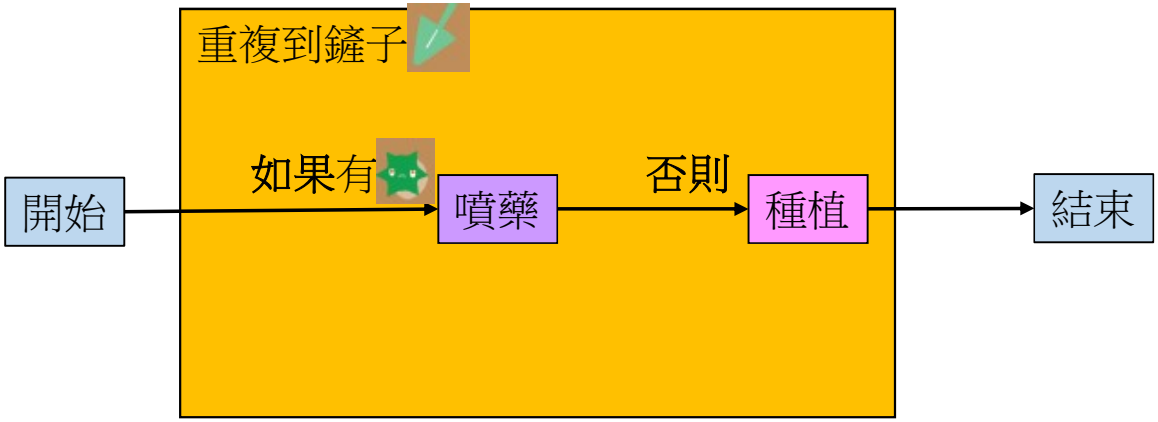
「如果...,就...」(if-then)

Many things are missing from this piece of instruction. Can you figure it out?

You know how to do this already!

選擇

「如果...,否則...」(if-else)

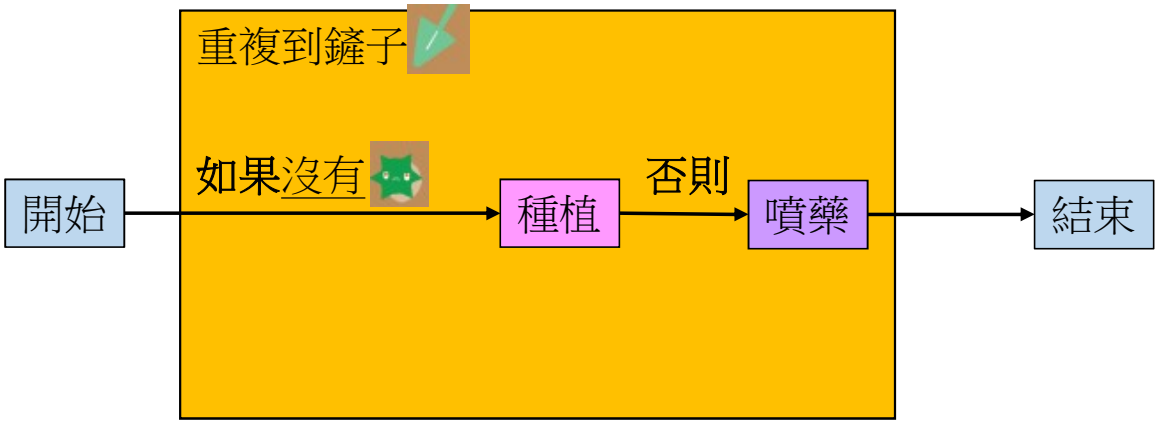


7

How would you instruct the Foxes to plant this row? Pay close attention to the word *not*.

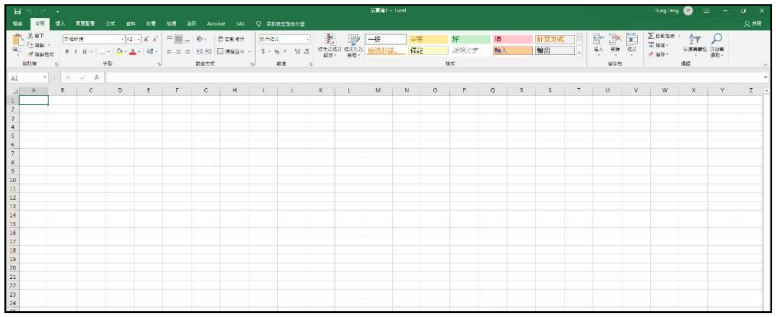
7

How would you instruct the Foxes to plant this row? Pay close attention to the word *not*.

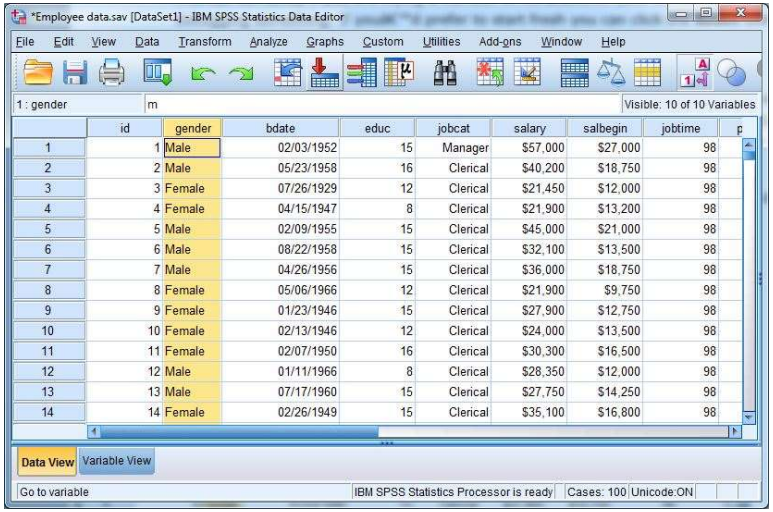


統計分析軟體
Statistical Analysis Software

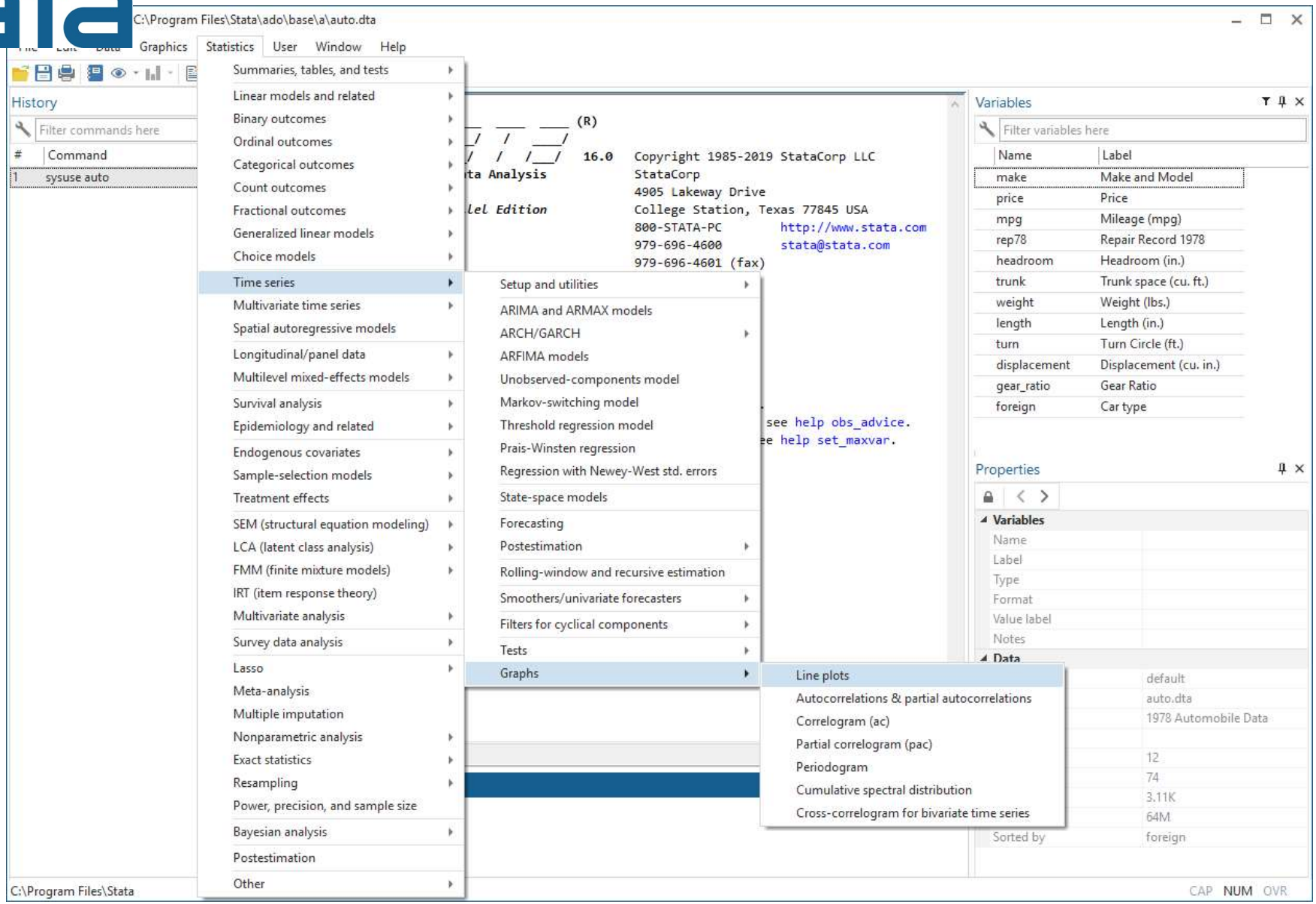
Microsoft Excel



SPSS



	id	gender	bdate	educ	jobcat	salary	salbegin	jobtime	p
1	1	Male	02/03/1952	15	Manager	$57,000	$27,000	98	
2	2	Male	05/23/1958	16	Clerical	$40,200	$18,750	98	
3	3	Female	07/26/1929	12	Clerical	$21,450	$12,000	98	
4	4	Female	04/15/1947	8	Clerical	$21,900	$13,200	98	
5	5	Male	02/09/1955	15	Clerical	$45,000	$21,000	98	
6	6	Male	08/22/1958	15	Clerical	$32,100	$13,500	98	
7	7	Male	04/26/1956	15	Clerical	$36,000	$18,750	98	
8	8	Female	05/06/1966	12	Clerical	$21,900	$9,750	98	
9	9	Female	01/23/1946	15	Clerical	$27,900	$12,750	98	
10	10	Female	02/13/1946	12	Clerical	$24,000	$13,500	98	
11	11	Female	02/07/1950	16	Clerical	$30,300	$16,500	98	
12	12	Male	01/11/1966	8	Clerical	$28,350	$12,000	98	
13	13	Male	07/17/1960	15	Clerical	$27,750	$14,250	98	
14	14	Female	02/26/1949	15	Clerical	$35,100	$16,800	98	


C:\Program Files\Stata\ado\base\a\auto.dta
Graphics
Statistics
User
Window
Help
History
Filter commands here
Command
1 sysuse auto
Summaries, tables, and tests
Linear models and related
Binary outcomes
Ordinal outcomes
Categorical outcomes
Count outcomes
Fractional outcomes
Generalized linear models
Choice models
Time series
Multivariate time series
Spatial autoregressive models
Longitudinal/panel data
Multilevel mixed-effects models
Survival analysis
Epidemiology and related
Endogenous covariates
Sample-selection models
Treatment effects
SEM (structural equation modeling)
LCA (latent class analysis)
FMM (finite mixture models)
IRT (item response theory)
Multivariate analysis
Survey data analysis
Lasso
Meta-analysis
Multiple imputation
Nonparametric analysis
Exact statistics
Resampling
Power, precision, and sample size
Bayesian analysis
Postestimation
Other
Setup and utilities
ARIMA and ARMAX models
ARCH/GARCH
ARFIMA models
Unobserved-components model
Markov-switching model
Threshold regression model
Prais-Winsten regression
Regression with Newey-West std. errors
State-space models
Forecasting
Postestimation
Rolling-window and recursive estimation
Smoothers/univariate forecasters
Filters for cyclical components
Tests
Graphs
Line plots
Autocorrelations & partial autocorrelations
Correlogram (ac)
Partial correlogram (pac)
Periodogram
Cumulative spectral distribution
Cross-correlogram for bivariate time series
(R)
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see help obs_advice.
help set_maxvar.
Variables
Filter variables here
Name Label
make Make and Model
price Price
mpg Mileage (mpg)
rep78 Repair Record 1978
headroom Headroom (in.)
trunk Trunk space (cu. ft.)
weight Weight (lbs.)
length Length (in.)
turn Turn Circle (ft.)
displacement Displacement (cu. in.)
gear_ratio Gear Ratio
foreign Car type
Properties
Variables
Name
Label
Type
Format
Value label
Notes
Data
default
auto.dta
1978 Automobile Data
12
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3.11K
64M
Sorted by foreign
C:\Program Files\Stata
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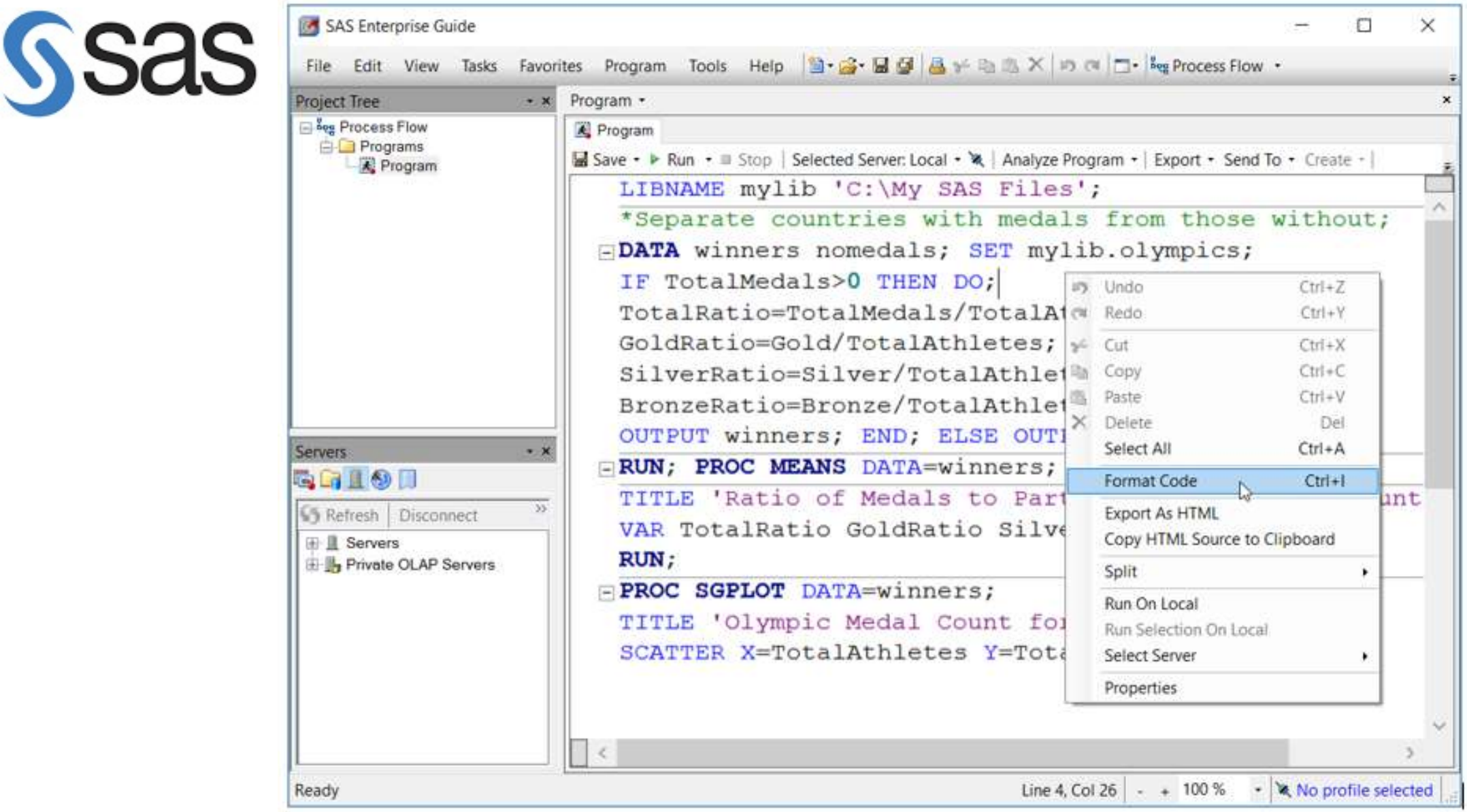
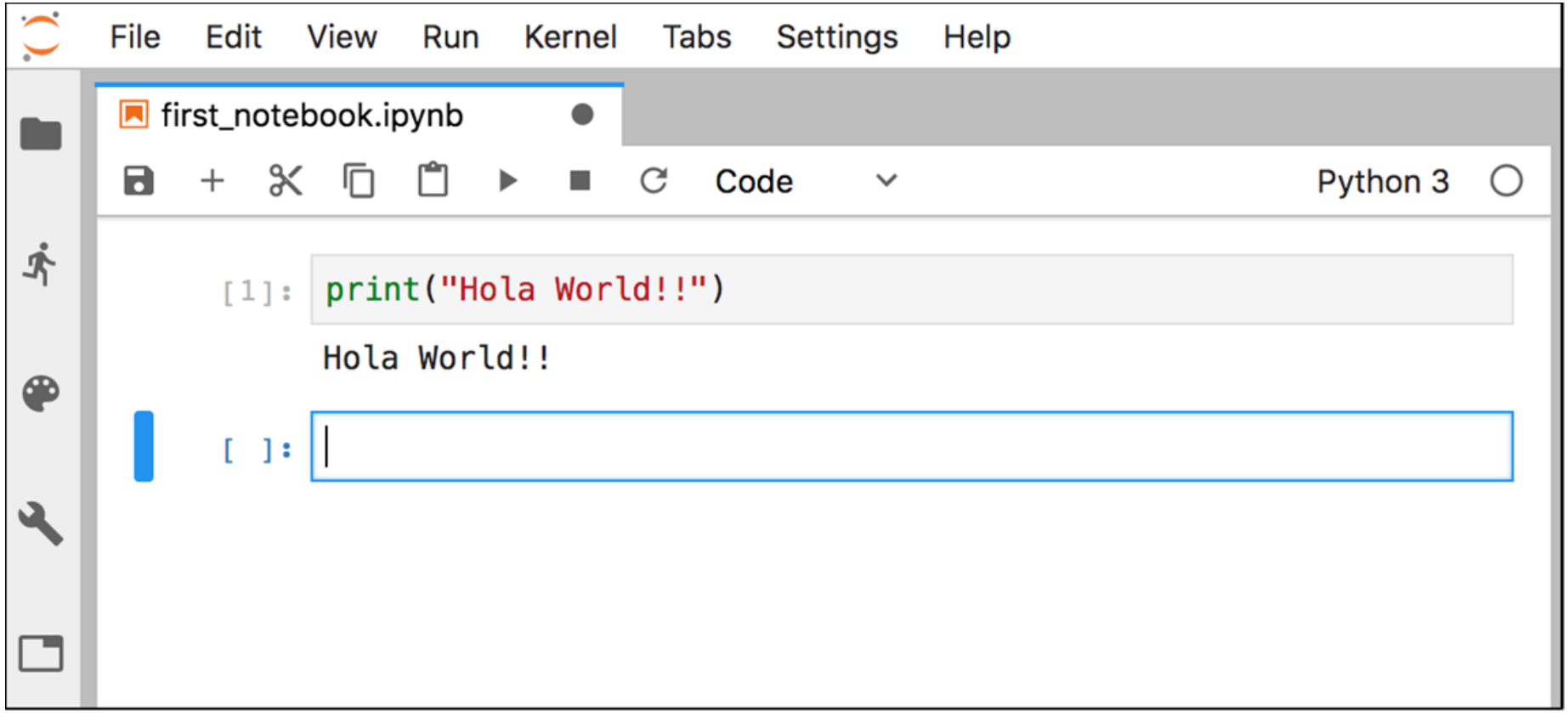
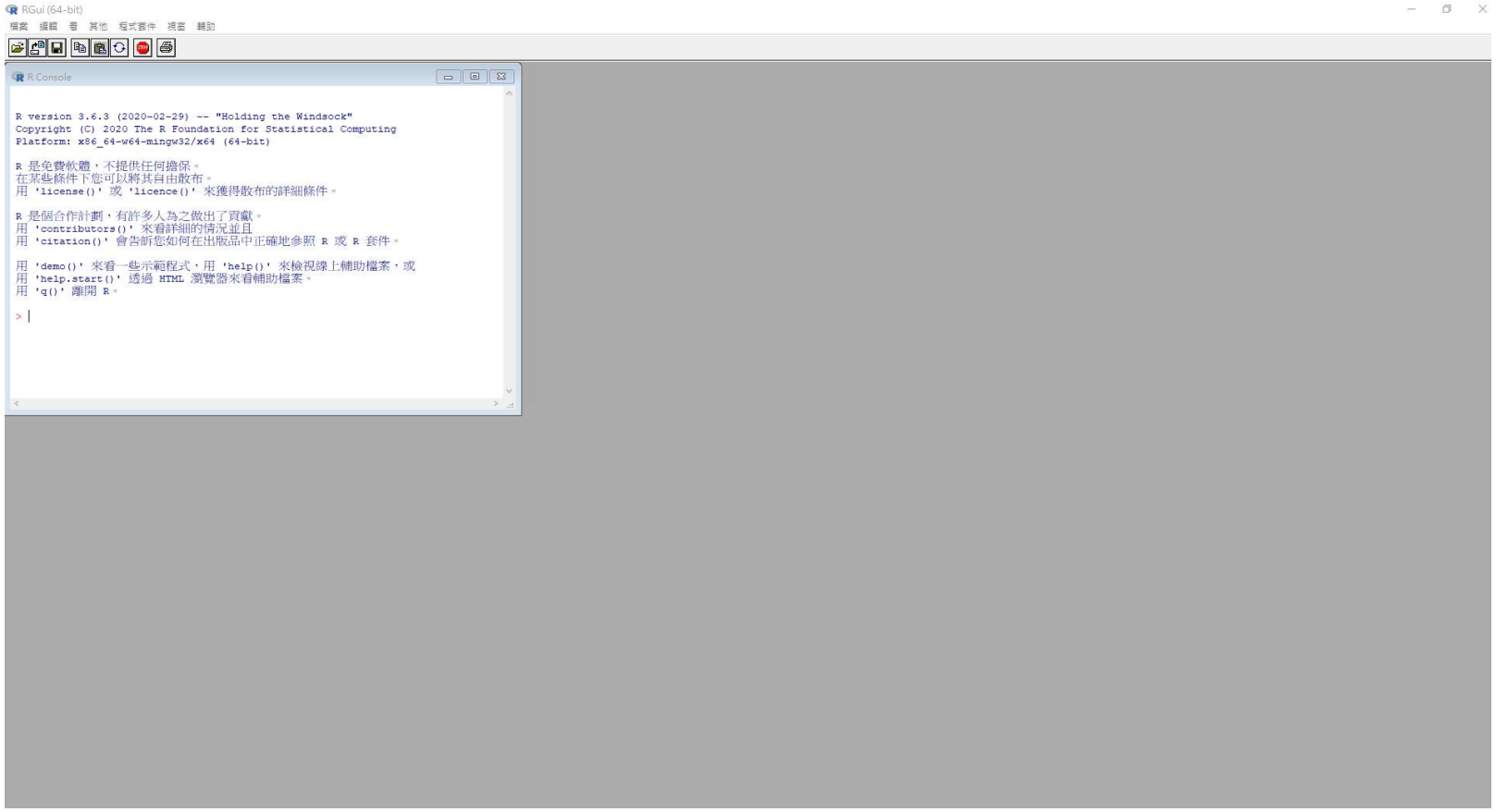

SAS Enterprise Guide
File Edit View Tasks Favorites Program Tools Help
Process Flow
Project Tree
Process Flow
Programs
Program
Program
Program
Save Run Stop Selected Server: Local Analyze Program Export Send To Create
LIBNAME mylib 'C:\My SAS Files';
*Separate countries with medals from those without;
DATA winners nomedals; SET mylib.olympics;
IF TotalMedals>0 THEN DO;
TotalRatio=TotalMedals/TotalAt
GoldRatio=Gold/TotalAthletes;
SilverRatio=Silver/TotalAthlet
BronzeRatio=Bronze/TotalAthlet
OUTPUT winners; END; ELSE OUT
RUN; PROC MEANS DATA=winners;
TITLE 'Ratio of Medals to Part
VAR TotalRatio GoldRatio Silve
RUN;
PROC SGPLOT DATA=winners;
TITLE 'Olympic Medal Count for
SCATTER X=TotalAthletes Y=Tota
Undo Ctrl+Z
Redo Ctrl+Y
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Delete Del
Select All Ctrl+A
Format Code Ctrl+I
Export As HTML
Copy HTML Source to Clipboard
Split
Run On Local
Run Selection On Local
Select Server
Properties
Servers
Refresh Disconnect
Servers
Private OLAP Servers
Ready
Line 4, Col 26
100 %
No profile selected

python™


File Edit View Run Kernel Tabs Settings Help
first_notebook.ipynb
Code
Python 3
[1]: print("Hola World!!")
Hola World!!
[ ]:


RGui (64-bit)
檔案 編輯 看 其他 程式套件 視窗 輔助
R Console
R version 3.6.3 (2020-02-29) -- "Holding the Windsock"
Copyright (C) 2020 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)
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R 是個合作計劃，有許多人為之做出了貢獻。
用 'contributors()' 來看詳細的情況並且
用 'citation()' 會告訴您如何在出版品中正確地參照 R 或 R 套件。
用 'demo()' 來看一些示範程式，用 'help()' 來檢視線上輔助檔案，或
用 'help.start()' 透過 HTML 瀏覽器來看輔助檔案。
用 'q()' 離開 R。
>

python™

R

sas

STATA®

Microsoft Excel

SPSS

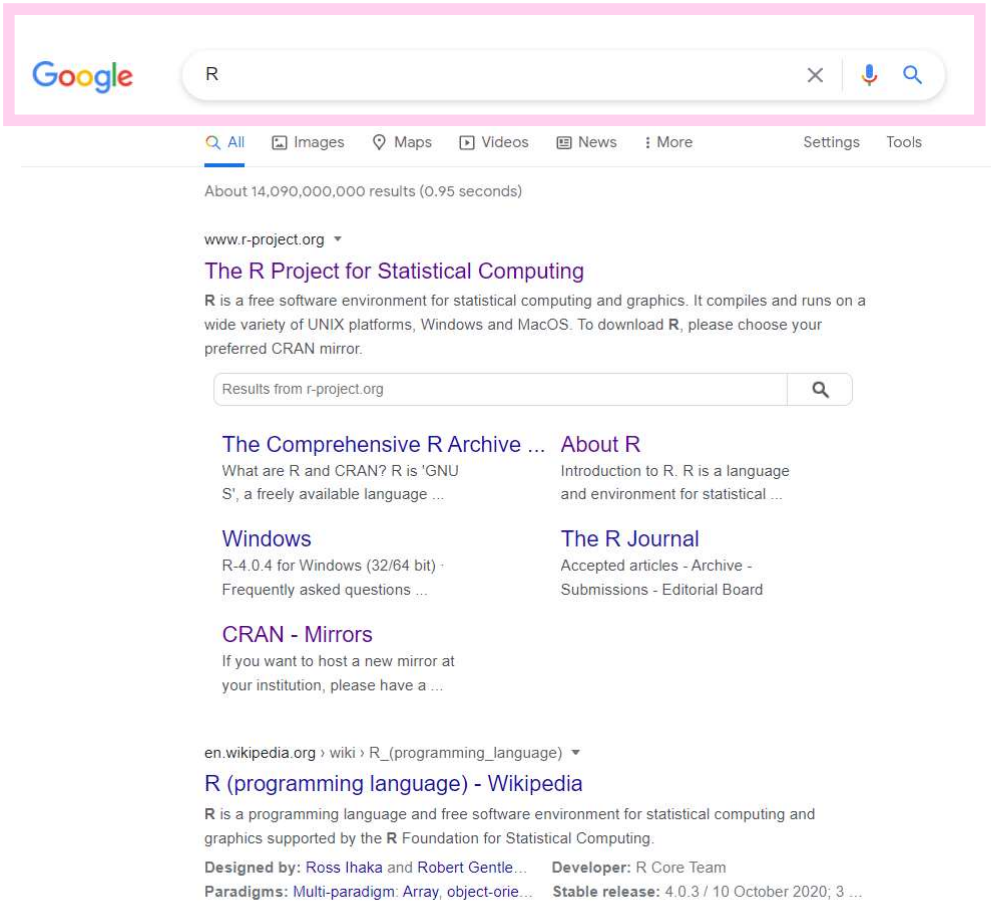
I. Getting R

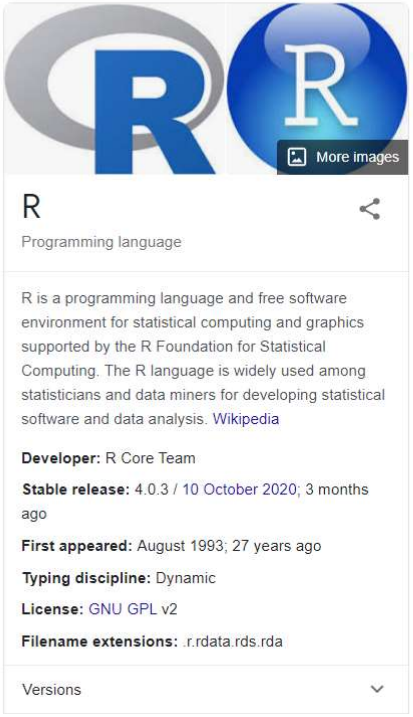
A. Downloading and Installing **R** 32-bit/ 64-bit (on Windows/ on Mac)
B. R environment
C. R version

- How to check
- How to update

- supported by

Ross Ihaka and Robert Gentleman





[Home]

Download

CRAN

R Project

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Donors
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Documentation

Manuals
FAQs
The R Journal
Books
Certification
Other

Links

Bioconductor
R-Forge
R-Hub
GSoC

The R Project for Statistical Computing

Getting Started

R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. To **download R**, please choose your preferred CRAN mirror.

If you have questions about R like how to download and install the software, or what the license terms are, please read our answers to frequently asked questions before you send an email.

News

- **R version 4.0.4 (Lost Library Book)** has been released on 2021-02-15.
- Thanks to the organisers of useR! 2020 for a successful online conference. Recorded tutorials and talks from the conference are available on the R Consortium YouTube channel.
- **R version 3.6.3 (Holding the Windsock)** was released on 2020-02-29.
- You can support the R Foundation with a renewable subscription as a supporting member

News via Twitter

The R Foundation Retweeted

Peter Dalgaard
@pdalgd
#rstats 4.0.4 "Lost Library Book" (source version) has been released.

Feb 15, 2021

The R Foundation
@_R_Foundation
Abstract submissions are open until Monday, March 15th
https://twitter.com/_useRconf/status/1354352011978956806

Feb 15, 2021

The R Foundation Retweeted

Dr Di Cook
@visnut
New issue of the R Journal is now available at journal.r-project.org #rstats @_R_Foundation papers on health, supervised and unsupervised learning, graphics and even Australian Rules football data

CRAN Mirrors

The Comprehensive R Archive Network is available at the following URLs, please choose a location close to you. Some statistics on the status of the mirrors can be found here: main page, windows release, windows old release.

If you want to host a new mirror at your institution, please have a look at the CRAN Mirror HOWTO.

Spain	
https://ftp.cixug.es/CRAN/	Oficina de software libre (CIXUG)
https://cran.rediris.es/	Spanish National Research Network, Madrid
Sweden	
https://ftpmirror1.infania.net/mirror/CRAN/	Infania Networks
https://ftp.acc.umu.se/mirror/CRAN/	Academic Computer Club, Umeå University
Switzerland	
https://stat.ethz.ch/CRAN/	ETH Zürich
Taiwan	
https://cran.csie.ntu.edu.tw/	National Taiwan University, Taipei
Thailand	
http://mirrors.psu.ac.th/pub/cran/	Prince of Songkla University, Hatyai
Turkey	
https://cran.pau.edu.tr/	Pamukkale University, Denizli
https://cran.gedik.edu.tr/	Istanbul Gedik University
https://cran.ncc.metu.edu.tr/	Middle East Technical University Northern Cyprus Campus, Mersin
UK	
https://www.stats.bris.ac.uk/R/	University of Bristol
https://cran.ma.imperial.ac.uk/	Imperial College London
USA	
https://mirror.las.iastate.edu/CRAN/	Iowa State University, Ames, IA
http://ftp.ussg.iu.edu/CRAN/	Indiana University
https://rweb.crmda.ku.edu/cran/	University of Kansas, Lawrence, KS
https://repo.miserver.it.umich.edu/cran/	MBNI, University of Michigan, Ann Arbor, MI
http://cran.wustl.edu/	Washington University, St. Louis, MO
http://archive.linux.duke.edu/cran/	Duke University, Durham, NC
https://cran.case.edu/	Case Western Reserve University, Cleveland, OH
https://ftp.osuosl.org/pub/cran/	Oregon State University
http://lib.stat.cmu.edu/R/CRAN/	Statlib, Carnegie Mellon University, Pittsburgh, PA
http://cran.mirrors.hoobly.com/	Hoobly Classifieds, Pittsburgh, PA
https://mirrors.nics.utk.edu/cran/	National Institute for Computational Sciences, Oak Ridge, TN
https://cran.microsoft.com/	Revolution Analytics, Dallas, TX
Uruguay	
https://espejito.fder.edu.uy/cran/	Facultad de Derecho, Universidad de la República

The Comprehensive R Archive Network

Download and Install R

Precompiled binary distributions of the base system and contributed packages, **Windows and Mac** users most likely want one of these versions of R:

- Download R for Linux
- Download R for (Mac) OS X
- Download R for Windows

R is part of many Linux distributions, you should check with your Linux package management system in addition to the link above.

Source Code for all Platforms

Windows and Mac users most likely want to download the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

- The latest release (2021-02-15, Lost Library Book) R-4.0.4.tar.gz, read what's new in the latest version.
- Sources of R alpha and beta releases (daily snapshots, created only in time periods before a planned release).
- Daily snapshots of current patched and development versions are available here. Please read about new features and bug fixes before filing corresponding feature requests or bug reports.
- Source code of older versions of R is available here.
- Contributed extension packages

Questions About R

- If you have questions about R like how to download and install the software, or what the license terms are, please read our answers to frequently asked questions before you send an email.

R for Windows

Subdirectories:

base	Binaries for base distribution. This is what you want to **install R for the first time**.
contrib	Binaries of contributed CRAN packages (for R >= 2.13.x; managed by Uwe Ligges). There is also information on third party software available for CRAN Windows services and corresponding environment and make variables.
old contrib	Binaries of contributed CRAN packages for outdated versions of R (for R < 2.13.x; managed by Uwe Ligges).
Rtools	Tools to build R and R packages. This is what you want to build your own packages on Windows, or to build R itself.

Please do not submit binaries to CRAN. Package developers might want to contact Uwe Ligges directly in case of questions / suggestions related to Windows binaries.

You may also want to read the R FAQ and R for Windows FAQ.

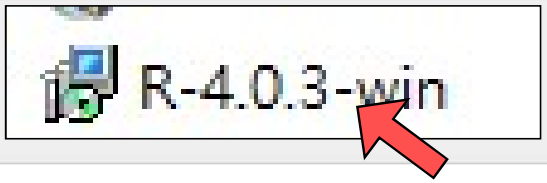
Note: CRAN does some checks on these binaries for viruses, but cannot give guarantees. Use the normal precautions with downloaded executables.

R-4.0.4 for Windows (32/64 bit)

Download R 4.0.4 for Windows (85 megabytes, 32/64 bit)

Installation and other instructions

New features in this version



安装

If you want to double-check that the package you have downloaded matches the package distributed by CRAN, you can compare the md5sum of the .exe to the fingerprint on the master server. You will need a version of md5sum for windows: both graphical and command line versions are available.

Frequently asked questions

- Does R run under my version of Windows?
- How do I update packages in my previous version of R?
- Should I run 32-bit or 64-bit R?

Please see the R FAQ for general information about R and the R Windows FAQ for Windows-specific information.

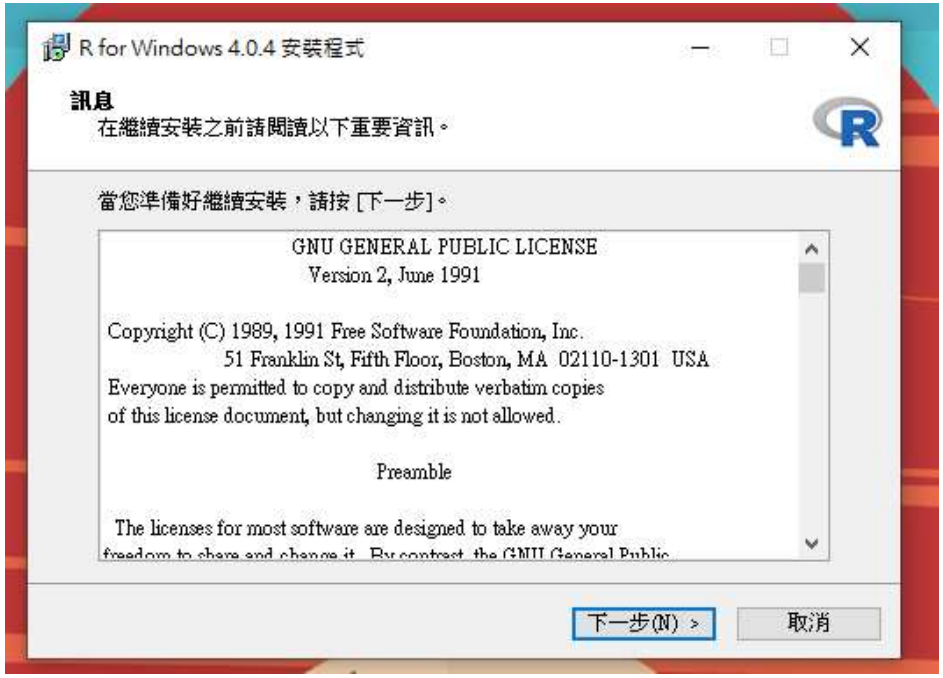
Other builds

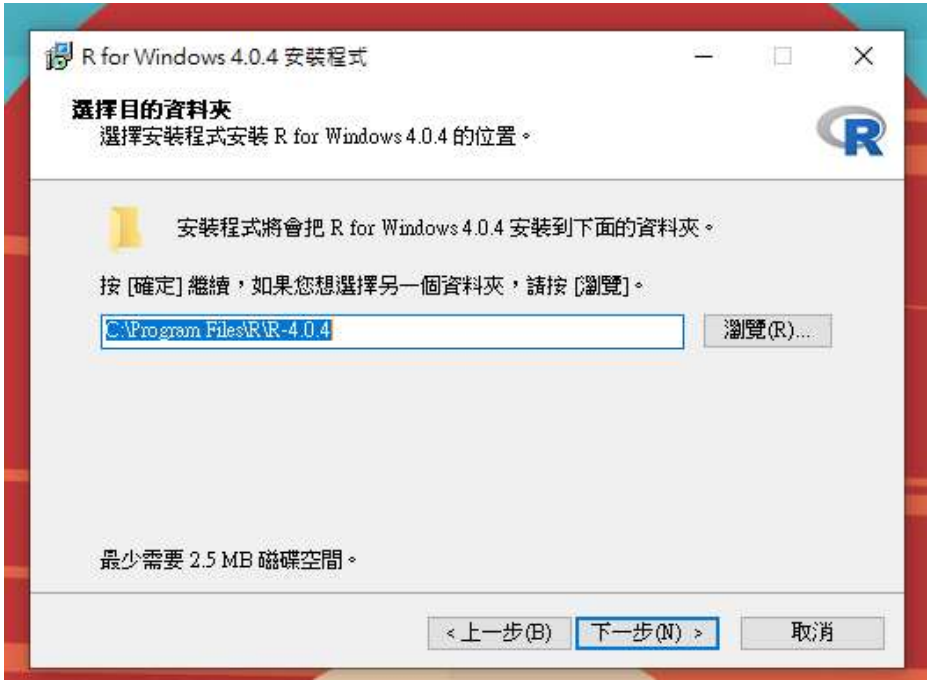
- Patches to this release are incorporated in the r-patched snapshot build.
- A build of the development version (which will eventually become the next major release of R) is available in the r-devel snapshot build.
- Previous releases

Note to webmasters: A stable link which will redirect to the current Windows binary release is <CRAN MIRROR>/bin/windows/base/release.html.

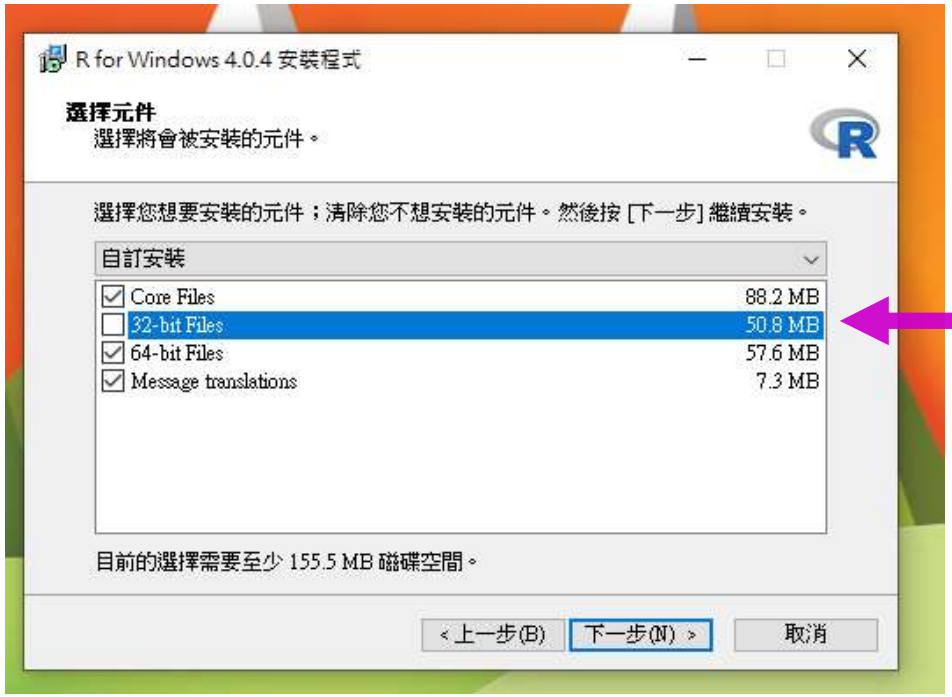

選擇安裝語言
選擇在安裝過程中使用的語言:
繁體中文
Català
Čeština
Dansk
Deutsch
English
Español
Français
Italiano
Nederlands
Norsk
Polski
Português (Portugal)
Português Brasileiro
Slovenski
Suomi
Русский

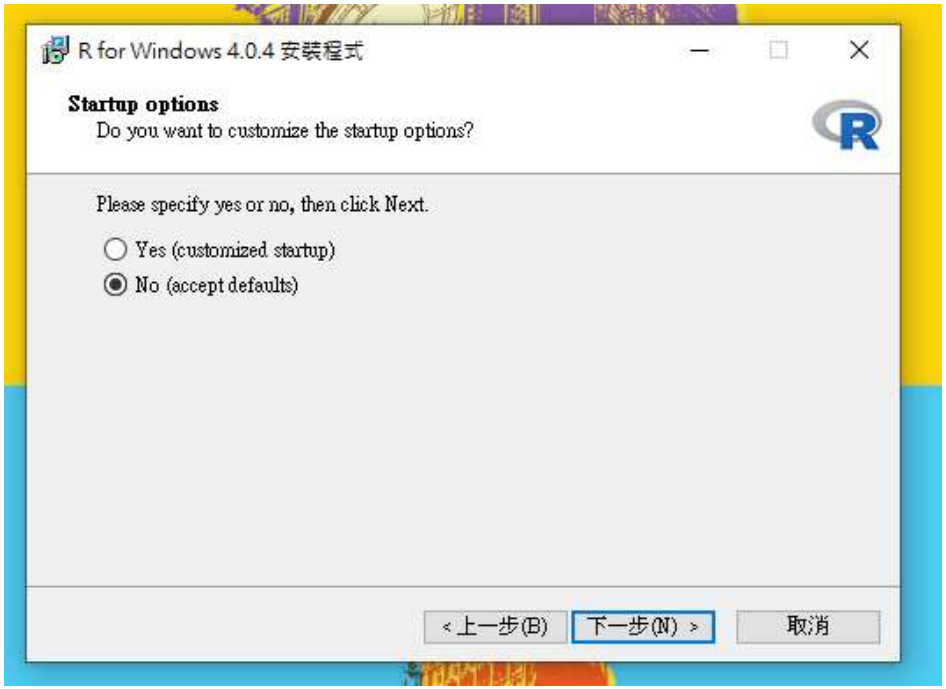

選擇安裝語言
選擇在安裝過程中使用的語言:
繁體中文
Français
Italiano
Nederlands
Norsk
Polski
Português (Portugal)
Português Brasileiro
Slovenski
Suomi
Русский
Українська
עברית
中文（简体）
日本語
繁體中文
한국어

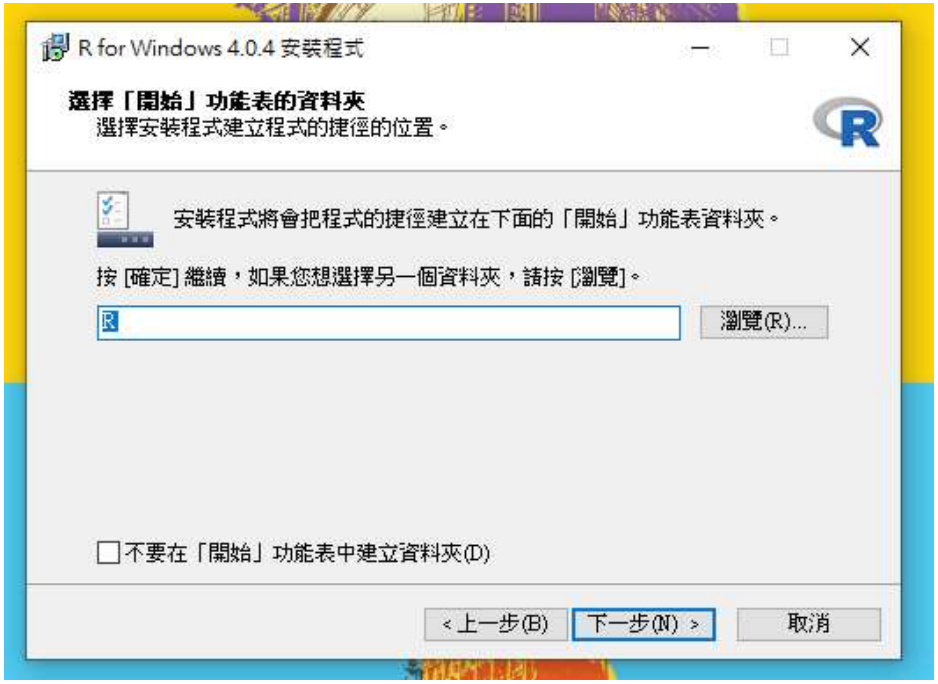


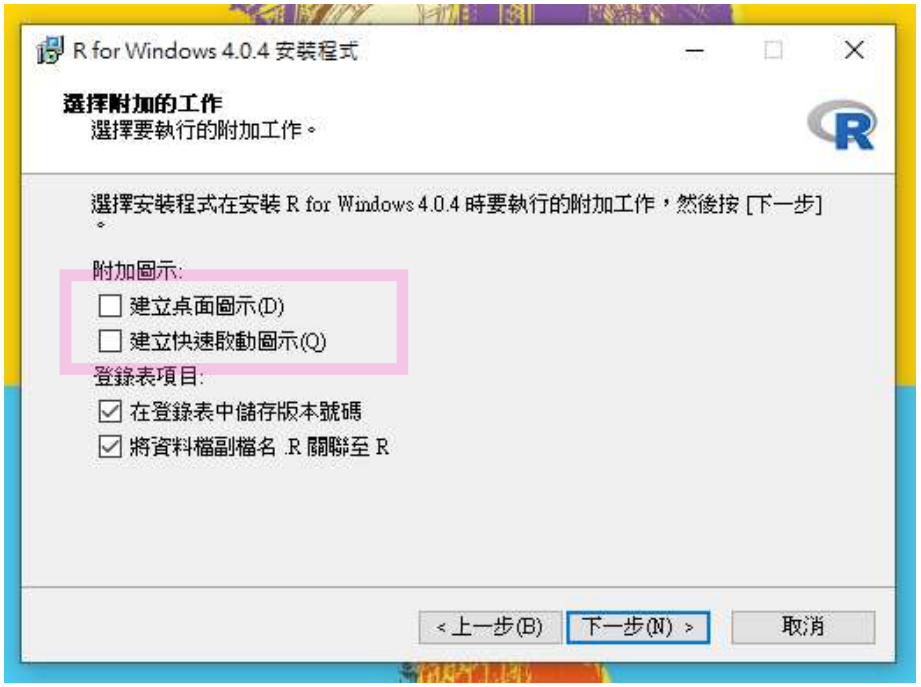


☺ R should be installed in a directory with **no spaces** in the name

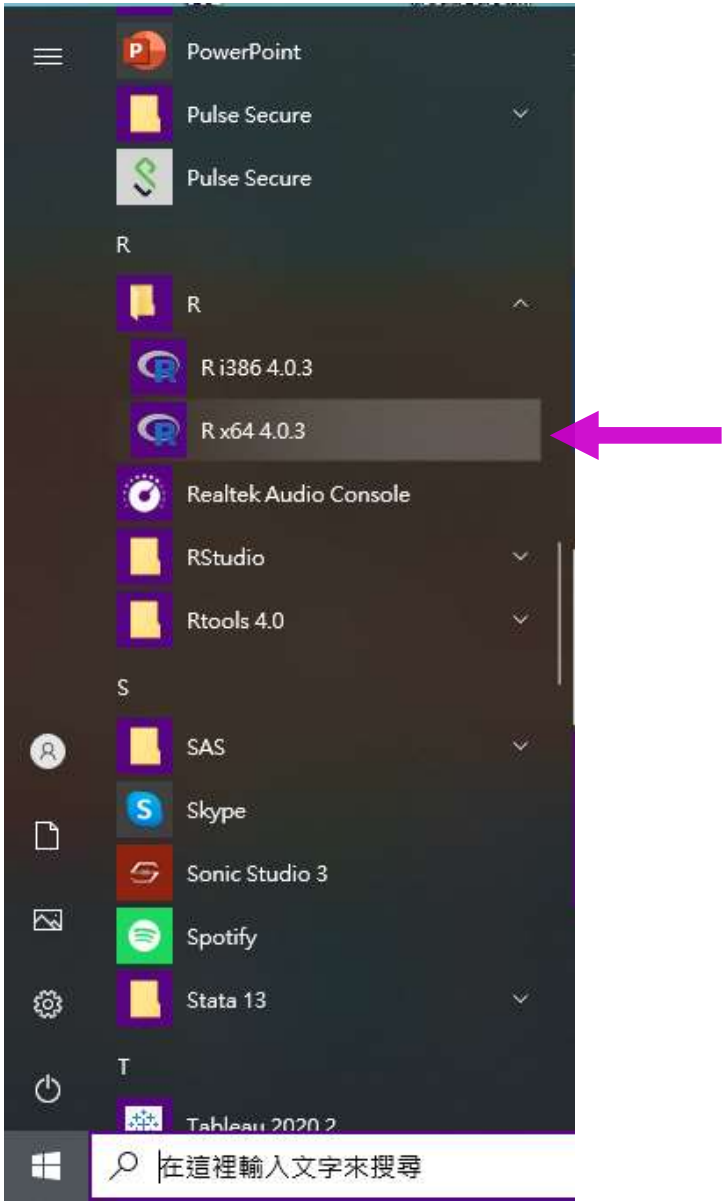

R for Windows 4.0.4 安裝程式
選擇元件
選擇將會被安裝的元件。
選擇您想要安裝的元件；清除您不想安裝的元件。然後按 [下一步] 繼續安裝。
自訂安裝
Core Files 88.2 MB
32-bit Files 50.8 MB
64-bit Files 57.6 MB
Message translations 7.3 MB
目前的選擇需要至少 155.5 MB 磁碟空間。
< 上一步(B)
下一步(N) >
取消

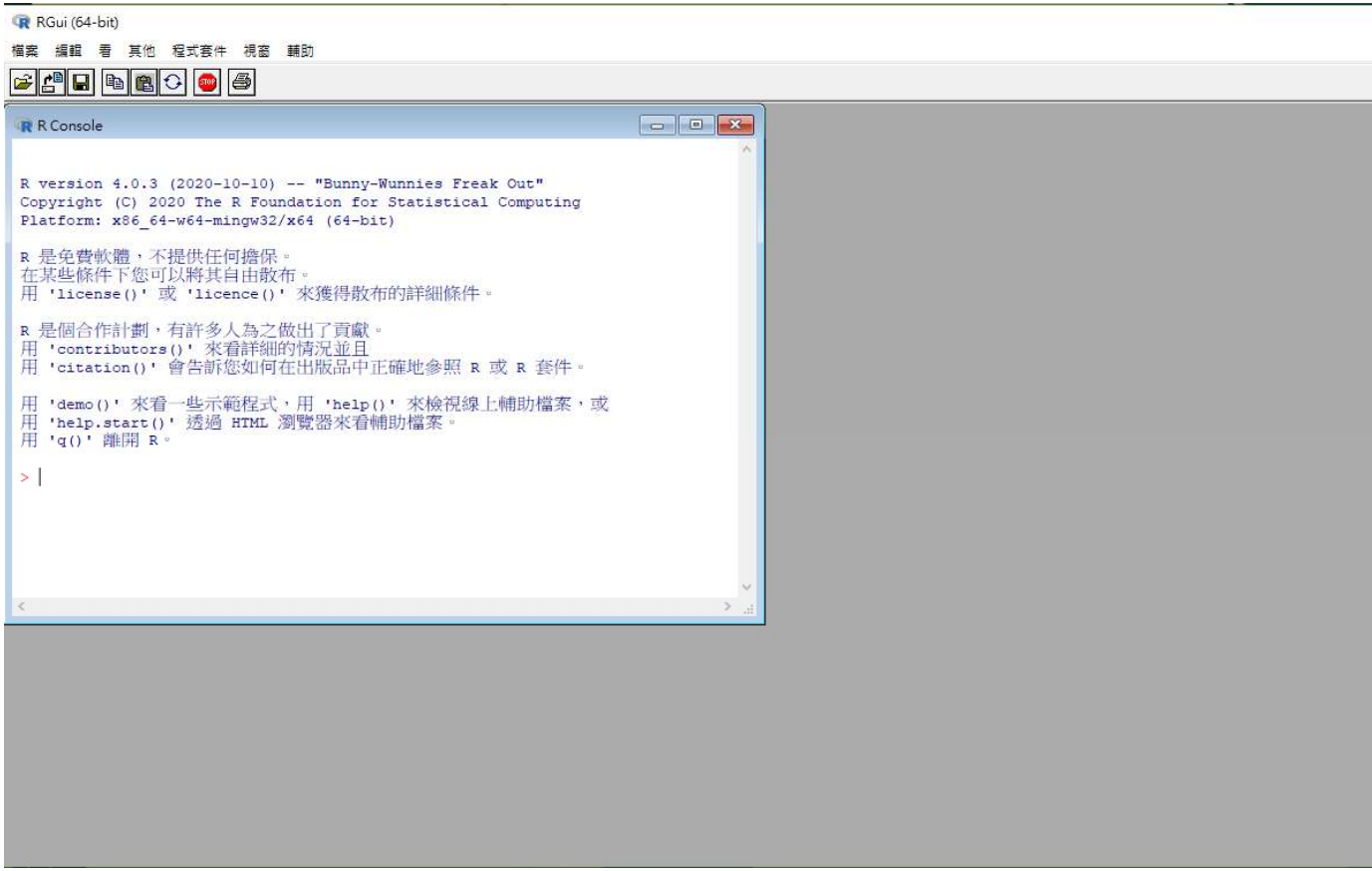

R for Windows 4.0.4 安裝程式
Startup options
Do you want to customize the startup options?
Please specify yes or no, then click Next.
Yes (customized startup)
No (accept defaults)
< 上一步(B)
下一步(N) >
取消





☺ click **Finish** to confirm this installation

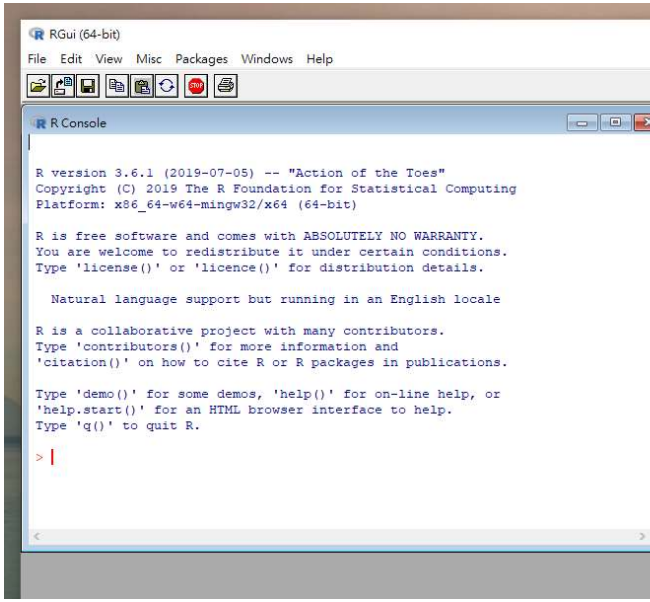

PowerPoint
Pulse Secure
Pulse Secure
R
R
R i386 4.0.3
R x64 4.0.3
Realtek Audio Console
RStudio
Rtools 4.0
S
SAS
Skype
Sonic Studio 3
Spotify
Stata 13
T
Tableau 2020.2
在這裡輸入文字來搜尋


RGui (64-bit)
檔案 編輯 看 其他 程式套件 視窗 輔助
R Console
R version 4.0.3 (2020-10-10) -- "Bunny-Wunnies Freak Out"
Copyright (C) 2020 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)
R 是免費軟體，不提供任何擔保。
在某些條件下您可以將其自由散布。
用 'license()' 或 'licence()' 來獲得散布的詳細條件。
R 是個合作計劃，有許多人為之做出了貢獻。
用 'contributors()' 來看詳細的情況並且
用 'citation()' 會告訴您如何在出版品中正確地參照 R 或 R 套件。
用 'demo()' 來看一些示範程式，用 'help()' 來檢視線上輔助檔案，或
用 'help.start()' 透過 HTML 瀏覽器來看輔助檔案。
用 'q()' 離開 R。
>

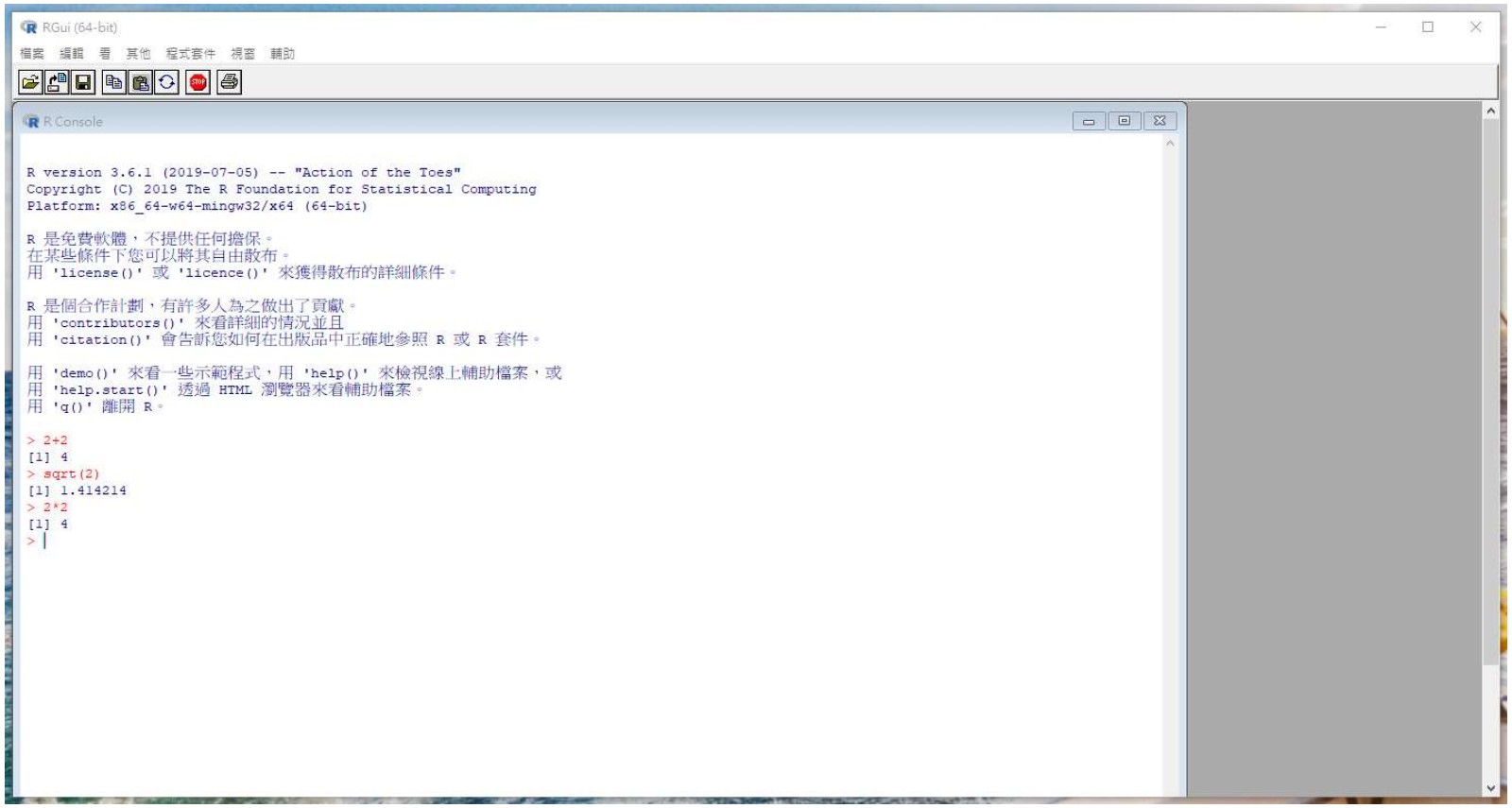

R x64
開啟(O)
以 Transfer 傳送...
以圖形處理器執行
開啟檔案位置(I)
Launch with Nsight HUD 2019.3
以系統管理員身分執行(A)
使用 Skype 分享
疑難排解相容性(Y)
釘選到開始畫面(P)
以 Avira 掃描選取的檔案(V)
加到壓縮檔(A)...
加到 "Rgui.rar"(T)
壓縮並發郵件...
壓縮成 "Rgui.rar" 並發郵件
釘選到工作列(K)
還原舊版(V)
傳送到(N)
剪下(T)
複製(C)
建立捷徑(S)
刪除(D)
重新命名(M)
內容(R)

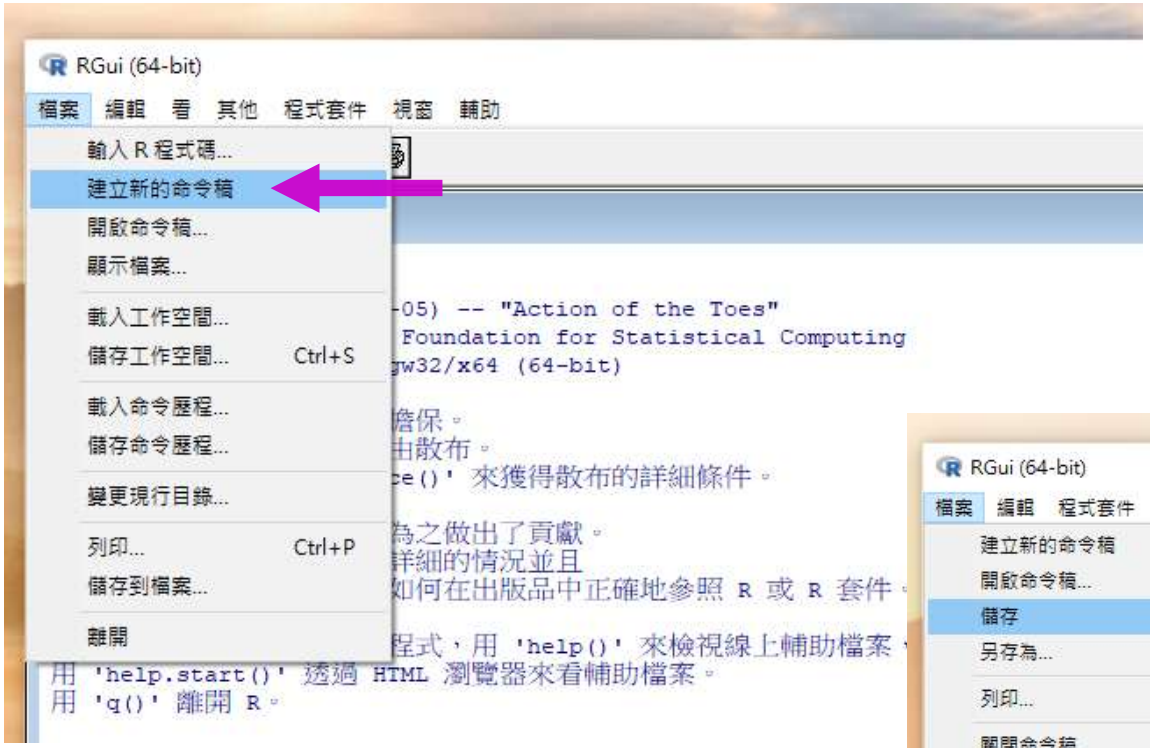

R x64 3.6.1 - 內容
一般
捷徑
相容性
安全性
詳細資料
以前的版本
R x64 3.6.1
目標類型: 應用程式
目標位置: x64
目標(T): x64\Rgui.exe" --cd-to-userdocs LANGUAGE=en
開始位置(S): "C:\Program Files\R\R-3.6.1"
快速鍵(K): 無
執行(R): 標準視窗
註解(O):
開啟檔案位置(F)
變更圖示(C)...
進階(D)...
確定
取消
套用(A)

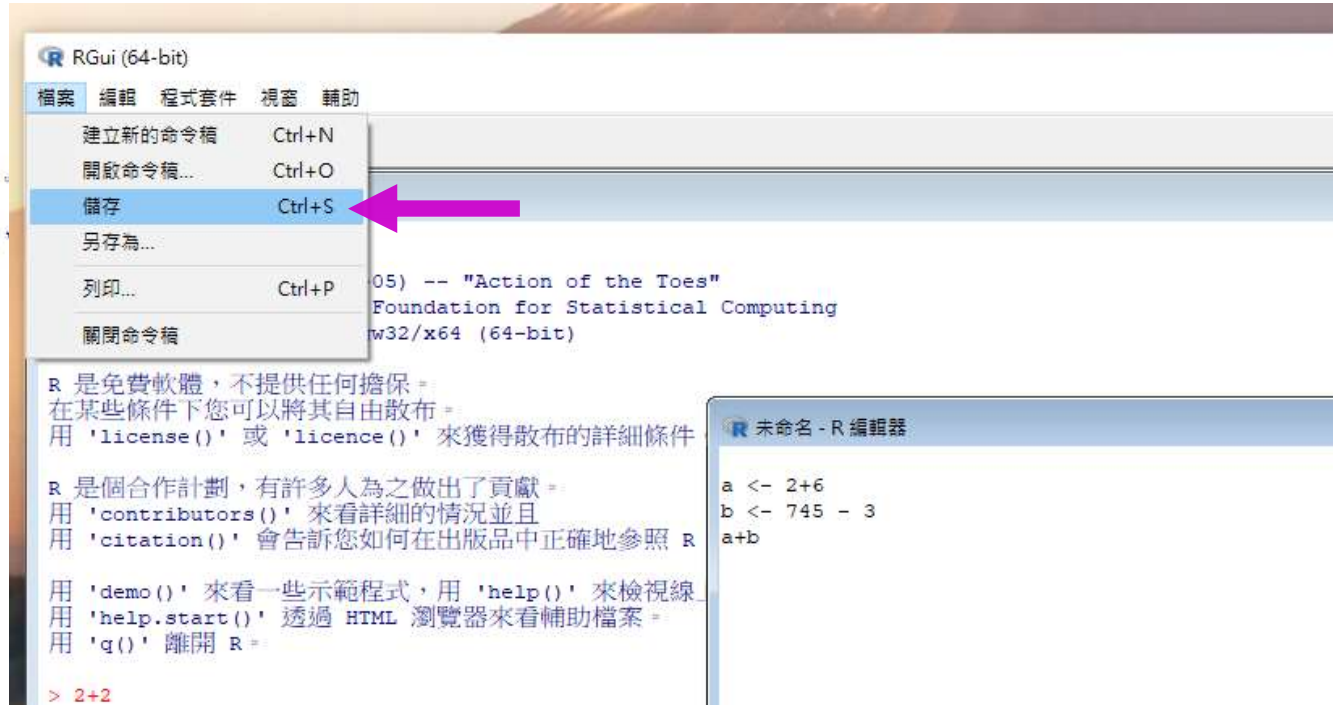
更改為英文介面


RGui (64-bit)
File Edit View Misc Packages Windows Help
R Console
R version 3.6.1 (2019-07-05) -- "Action of the Toes"
Copyright (C) 2019 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)
R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.
Natural language support but running in an English locale
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.
>

R console 控制台 – 執行R指令




RGui (64-bit)
檔案 編輯 看 其他 程式套件 視窗 輔助
輸入 R 程式碼...
建立新的命令稿
開啟命令稿...
顯示檔案...
載入工作空間...
儲存工作空間... Ctrl+S
載入命令歷程...
儲存命令歷程...
變更現行目錄...
列印... Ctrl+P
儲存到檔案...
離開
-05) -- "Action of the Toes"
Foundation for Statistical Computing
gw32/x64 (64-bit)
擔保。
出散布。
ce()' 來獲得散布的詳細條件。
為之做出了貢獻。
詳細的情況並且
如何在出版品中正確地參照 R 或 R 套件。
程式，用 'help()' 來檢視線上輔助檔案，
用 'help.start()' 透過 HTML 瀏覽器來看輔助檔案。
用 'q()' 離開 R。


RGui (64-bit)
檔案 編輯 程式套件 視窗 輔助
建立新的命令稿 Ctrl+N
開啟命令稿... Ctrl+O
儲存 Ctrl+S
另存為...
列印... Ctrl+P
關閉命令稿
-05) -- "Action of the Toes"
Foundation for Statistical Computing
w32/x64 (64-bit)
R 是免費軟體，不提供任何擔保。
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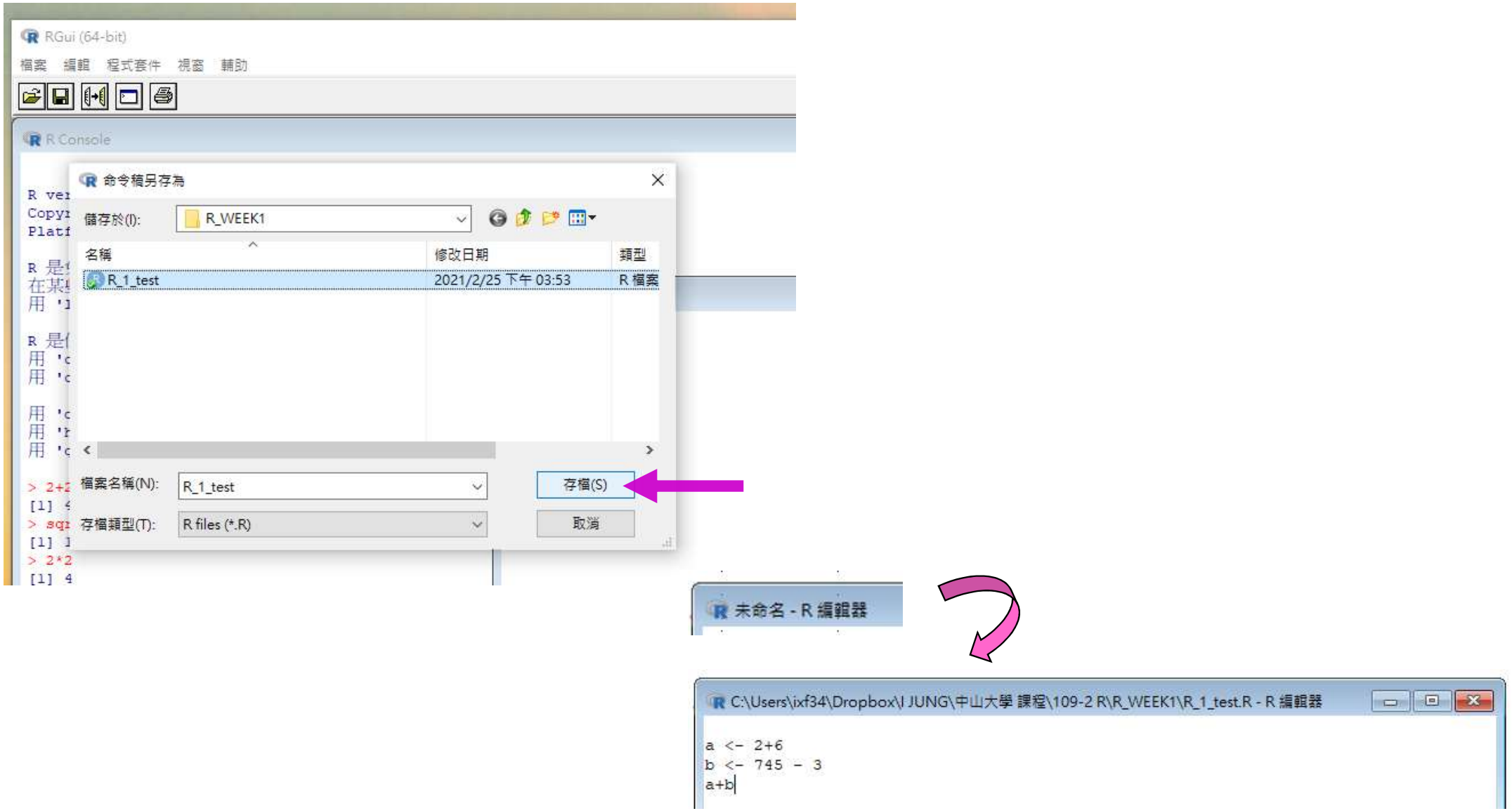
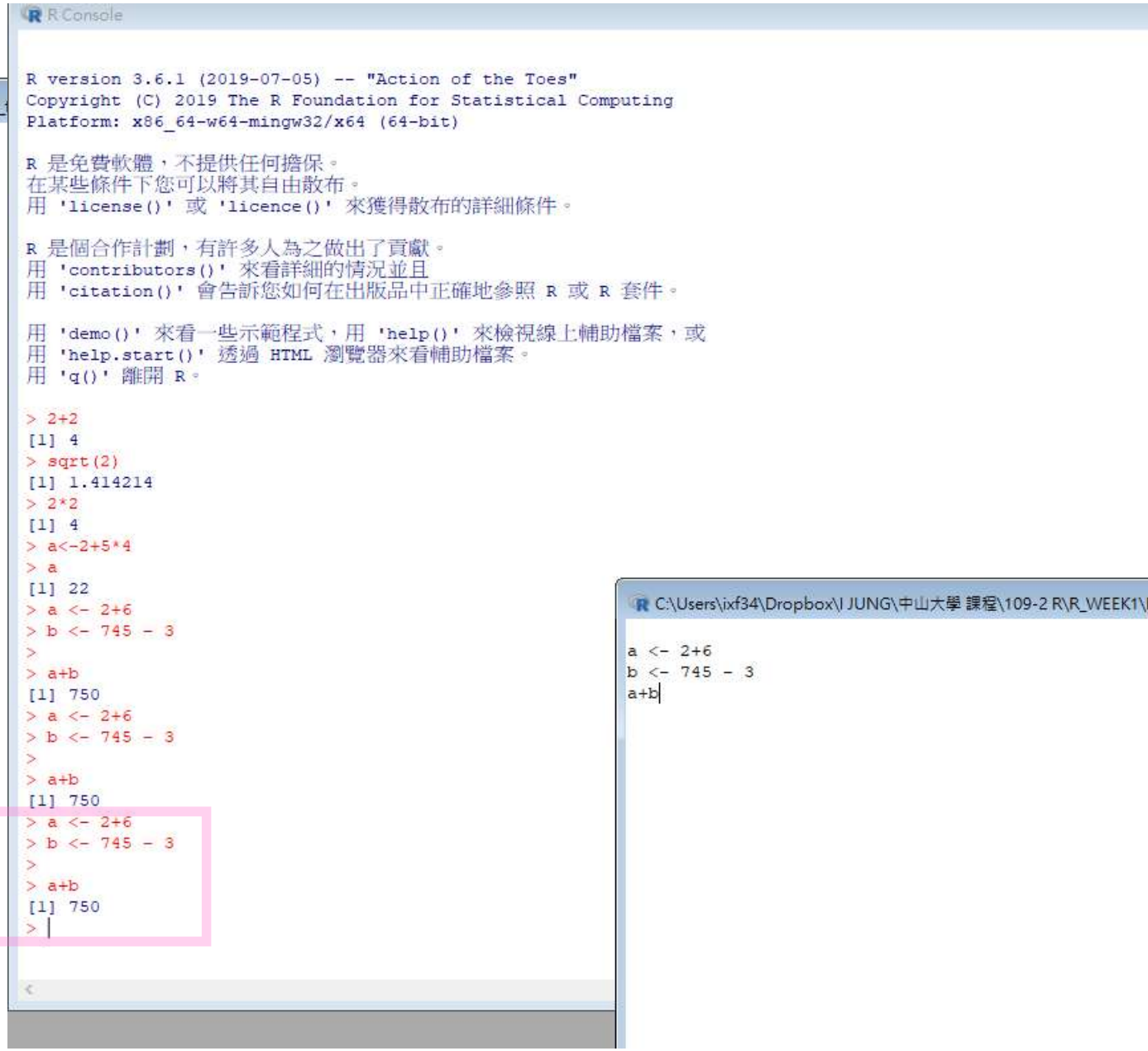
用 'citation()' 會告訴您如何在出版品中正確地參照 R
用 'demo()' 來看一些示範程式，用 'help()' 來檢視線
用 'help.start()' 透過 HTML 瀏覽器來看輔助檔案。
用 'q()' 離開 R。
> 2+2
未命名 - R 編輯器
a <- 2+6
b <- 745 - 3
a+b


RGui (64-bit)
檔案 編輯 程式套件 視窗 輔助
R Console
命令稿另存為
儲存於(I):
R_WEEK1
名稱
修改日期
類型
R_1_test
2021/2/25 下午 03:53
R 檔案
檔案名稱(N):
R_1_test
存檔(S)
存檔類型(T):
R files (*.R)
取消
未命名 - R 編輯器
C:\Users\ixf34\Dropbox\I JUNG\中山大學 課程\109-2 R\R_WEEK1\R_1_test.R - R 編輯器
a <- 2+6
b <- 745 - 3
a+b


選取指令
a <- 2+6
執行程式列或選擇項 Ctrl+R
復原 Ctrl+Z
剪下 Ctrl+X
複製 Ctrl+C
貼上 Ctrl+V
刪除
全部選取 Ctrl+A


R Console
R version 3.6.1 (2019-07-05) -- "Action of the Toes"
Copyright (C) 2019 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)
R 是免費軟體，不提供任何擔保。
在某些條件下您可以將其自由散布。
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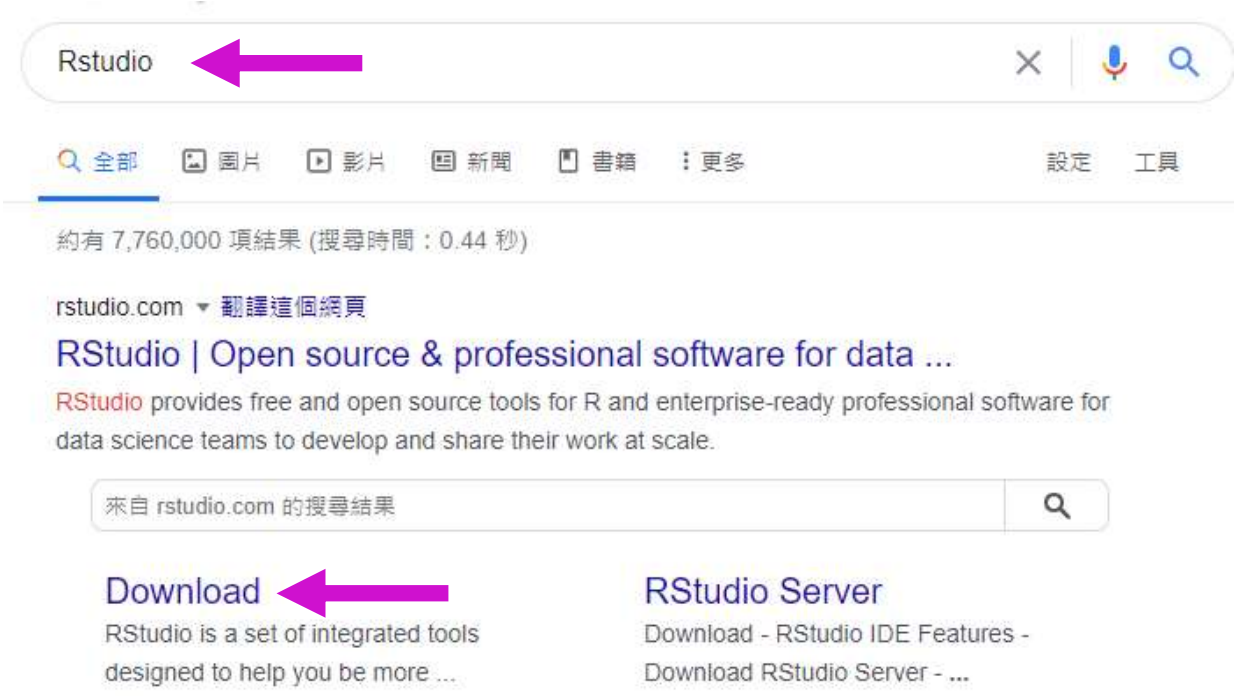
R 是個合作計劃，有許多人為之做出了貢獻。
用 'contributors()' 來看詳細的情況並且
用 'citation()' 會告訴您如何在出版品中正確地參照 R 或 R 套件。
用 'demo()' 來看一些示範程式，用 'help()' 來檢視線上輔助檔案，或
用 'help.start()' 透過 HTML 瀏覽器來看輔助檔案。
用 'q()' 離開 R。
> 2+2
[1] 4
> sqrt(2)
[1] 1.414214
> 2*2
[1] 4
> a<-2+5*4
> a
[1] 22
> a <- 2+6
> b <- 745 - 3
>
> a+b
[1] 750
> a <- 2+6
> b <- 745 - 3
>
> a+b
[1] 750
> a <- 2+6
> b <- 745 - 3
>
> a+b
[1] 750
>
C:\Users\ixf34\Dropbox\I JUNG\中山大學 課程\109-2 R\R_WEEK1\
a <- 2+6
b <- 745 - 3
a+b

II. Getting Rstudio

A. Downloading and Installing Rstudio

B. Rstudio tools

C. Rstudio environment



RStudio

DOWNLOAD SUPPORT DOCS COMMUNITY

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Download the RStudio IDE

Choose Your Version

The RStudio IDE is a set of integrated tools designed to help you be more productive with R and Python. It includes a console, syntax-highlighting editor that supports direct code execution, and a variety of robust tools for plotting, viewing history, debugging and managing your workspace.

LEARN MORE ABOUT RSTUDIO FEATURES

RStudio's recommended professional data science solution for every team. RStudio Team is a bundle of RStudio's popular professional software for data analysis, package management, and sharing data products.

Learn more about RStudio Team

RStudio Desktop	RStudio Desktop Pro	RStudio Server	RStudio Server Pro
Open Source License	Commercial License	Open Source License	Commercial License
Free	**$995** /year	**Free**	**$4,975** /year (5 Named Users)
DOWNLOAD	BUY	DOWNLOAD	BUY
Learn more	Learn more	Learn more	Evaluation | Learn more

RStudio Desktop 1.4.1106 - Release Notes

1. Install R. RStudio requires R 3.0.1+.

2. Download RStudio Desktop. Recommended for your system:

DOWNLOAD RSTUDIO FOR WINDOWS
1.4.1106 | 155.97MB

Requires Windows 10/8/7 (64-bit)

All Installers

Linux users may need to import RStudio's public code-signing key prior to installation, depending on the operating system's security policy.

RStudio requires a 64-bit operating system. If you are on a 32 bit system, you can use an older version of RStudio.

OS	Download	Size	SHA-256
Windows 10/8/7	RStudio-1.4.1106.exe	155.97 MB	d2ff8453
macOS 10.13+	RStudio-1.4.1106.dmg	153.35 MB	c64d2cda
Ubuntu 16	rstudio-1.4.1106-amd64.deb	118.45 MB	1fc82387
Ubuntu 18/Debian 10	rstudio-1.4.1106-amd64.deb	121.07 MB	3b5d3835
Fedora 19/Red Hat 7	rstudio-1.4.1106-x86_64.rpm	138.18 MB	a9e6ddc4
Fedora 28/Red Hat 8	rstudio-1.4.1106-x86_64.rpm	138.16 MB	35e57c1c
Debian 9	rstudio-1.4.1106-amd64.deb	121.33 MB	c7c9dd68
OpenSUSE 15	rstudio-1.4.1106-x86_64.rpm	123.57 MB	3539d9c3


RStudio-1.4.1106


RStudio 安裝
歡迎使用 RStudio 安裝精靈
本精靈會引導您完成安裝 RStudio。
在開始安裝之前，建議先關閉其他所有應用程式。這將允許安裝程式更新相關的系統檔案，而不需要重新啟動電腦。
按「下一步(N)」繼續。
下一步(N) >
取消


×2

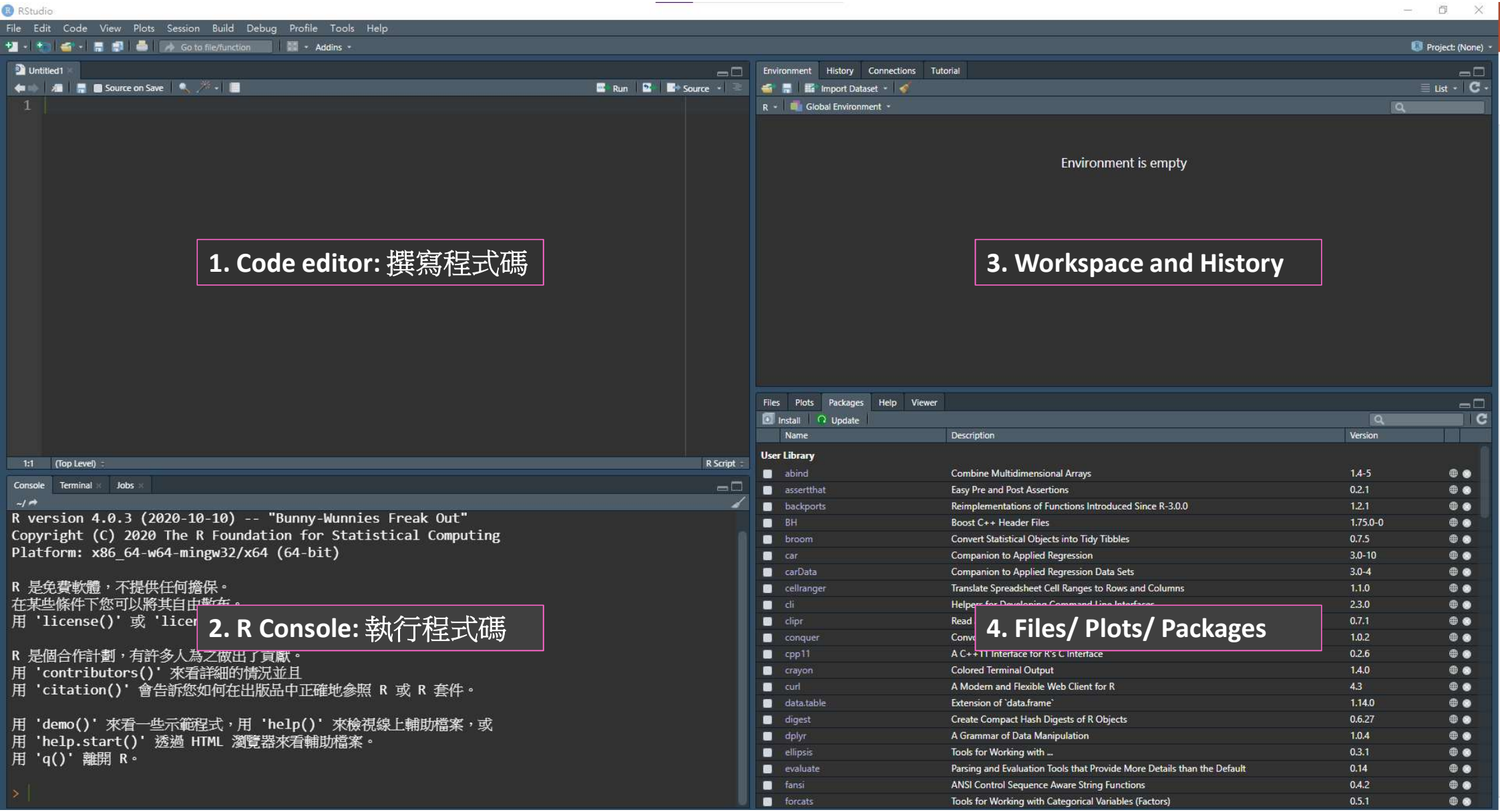

RStudio

II. Getting Rstudio

A. Downloading and Installing Rstudio ☑

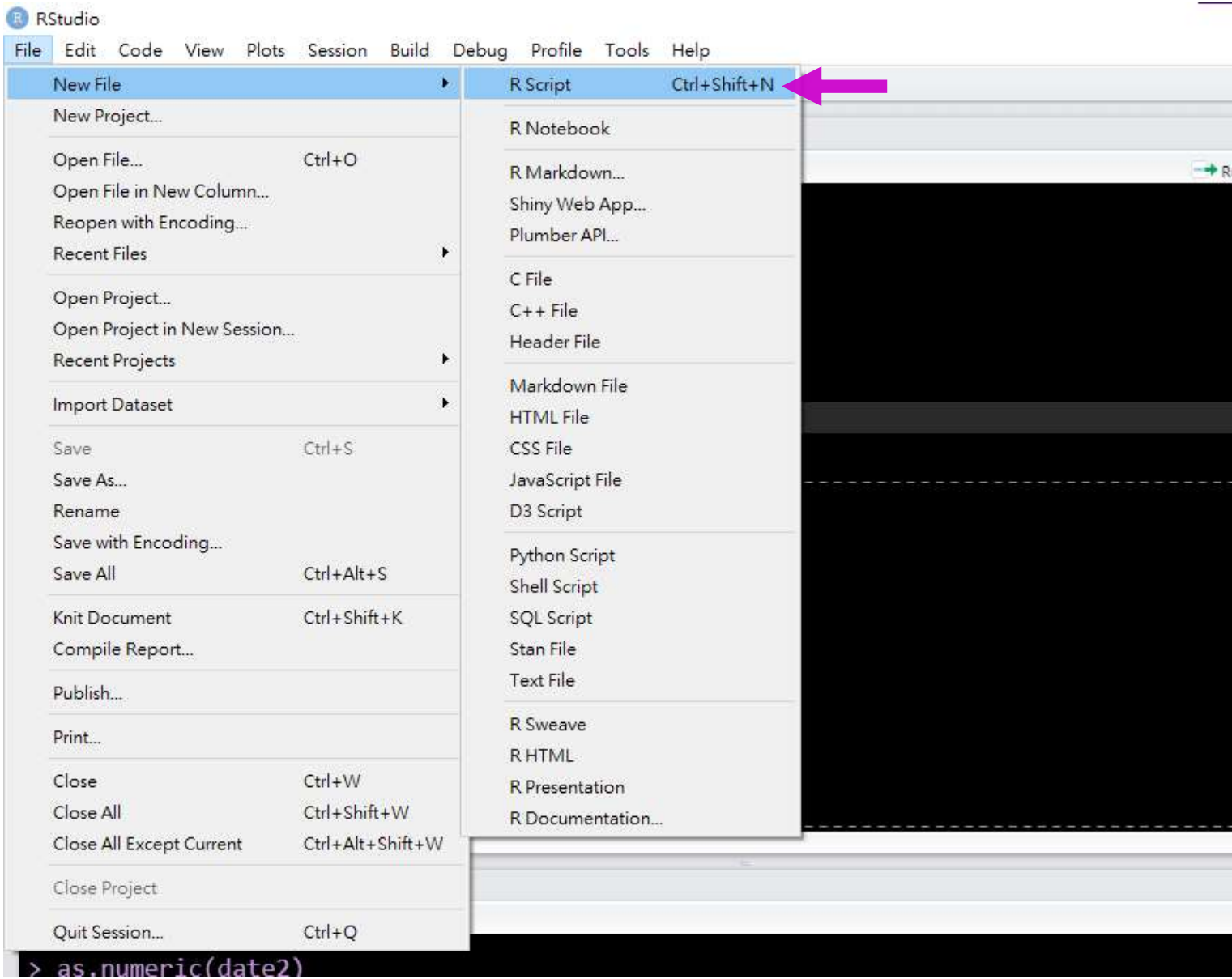
B. Rstudio environment and basic operation

C. Rstudio tools


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Project: (None)
Untitled1
Source on Save
Run
Source
1
1. Code editor: 撰寫程式碼
1:1
(Top Level)
R Script
Console
Terminal
Jobs
R version 4.0.3 (2020-10-10) -- "Bunny-Wunnies Freak Out"
Copyright (C) 2020 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)
R 是免費軟體，不提供任何擔保。
用 'license()' 或 'licen
2. R Console: 執行程式碼
R 是個合作計劃，有許多人為之做出了貢獻。
用 'contributors()' 來看詳細的情況並且
用 'citation()' 會告訴您如何在出版品中正確地參照 R 或 R 套件。
用 'demo()' 來看一些示範程式，用 'help()' 來檢視線上輔助檔案，或
用 'help.start()' 透過 HTML 瀏覽器來看輔助檔案。
用 'q()' 離開 R。
>
Environment
History
Connections
Tutorial
Import Dataset
List
R
Global Environment
Environment is empty
3. Workspace and History
Files
Plots
Packages
Help
Viewer
Install
Update
Name
Description
Version
User Library
abind
Combine Multidimensional Arrays
1.4-5
assertthat
Easy Pre and Post Assertions
0.2.1
backports
Reimplementations of Functions Introduced Since R-3.0.0
1.2.1
BH
Boost C++ Header Files
1.75.0-0
broom
Convert Statistical Objects into Tidy Tibbles
0.7.5
car
Companion to Applied Regression
3.0-10
carData
Companion to Applied Regression Data Sets
3.0-4
cellranger
Translate Spreadsheet Cell Ranges to Rows and Columns
1.1.0
cli
2.3.0
clipr
0.7.1
conquer
1.0.2
cpp11
0.2.6
crayon
Colored Terminal Output
1.4.0
curl
A Modern and Flexible Web Client for R
4.3
data.table
Extension of `data.frame`
1.14.0
digest
Create Compact Hash Digests of R Objects
0.6.27
dplyr
A Grammar of Data Manipulation
1.0.4
ellipsis
Tools for Working with ...
0.3.1
evaluate
Parsing and Evaluation Tools that Provide More Details than the Default
0.14
fansi
ANSI Control Sequence Aware String Functions
0.4.2
forcats
Tools for Working with Categorical Variables (Factors)
0.5.1
4. Files/ Plots/ Packages

1. 開啟新 R script 檔案

File >> New File >> R script



RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

2. 撰寫程式

3.執行程式碼
3-1 選取程式碼

Untitled1* | Source on Save | Run | Source

```
1 a <- 12+5
2 b <- 6+4
3
4 a+b
```

3-2. 執行程式碼	
2-1 Mac	2-2 Windows & Linux
Command + Enter	Ctrl + Enter

Environment | History | Connections | Tutorial

Import Dataset | List

R | Global Environment

Values

a	17
b	10

- Environment：目前變數的數值
- History：在 Consloe 執行過程式碼的歷史記錄。

Console | Terminal | Jobs

```
在某些條件下您可以將其自由散布。
用 'license()' 或 'licence()' 來獲得散布的詳細條件。

R 是個合作計劃，有許多人為之做出了貢獻。
用 'contributors()' 來看詳細的情況並且
用 'citation()' 會告訴您如何在出版品中正確地參照 R 或 R 套件。

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用 'help.start()' 透過 HTML 瀏覽器來看輔助檔案。
用 'q()' 離開 R。

> a <- 12+5
> b <- 6+4
>
> a+b
[1] 27
>
```
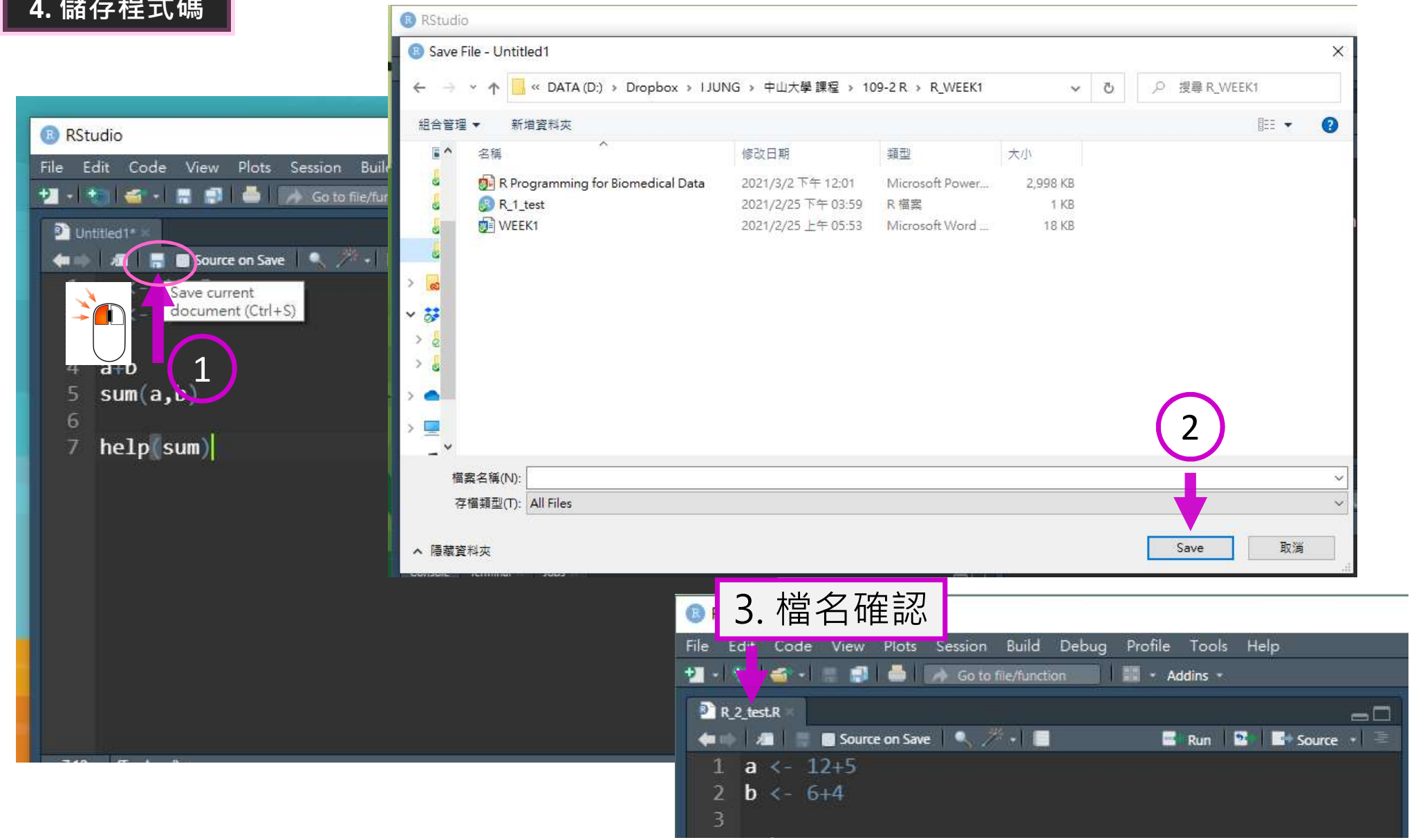

Files | Plots | Packages | Help | Viewer

Install | Update

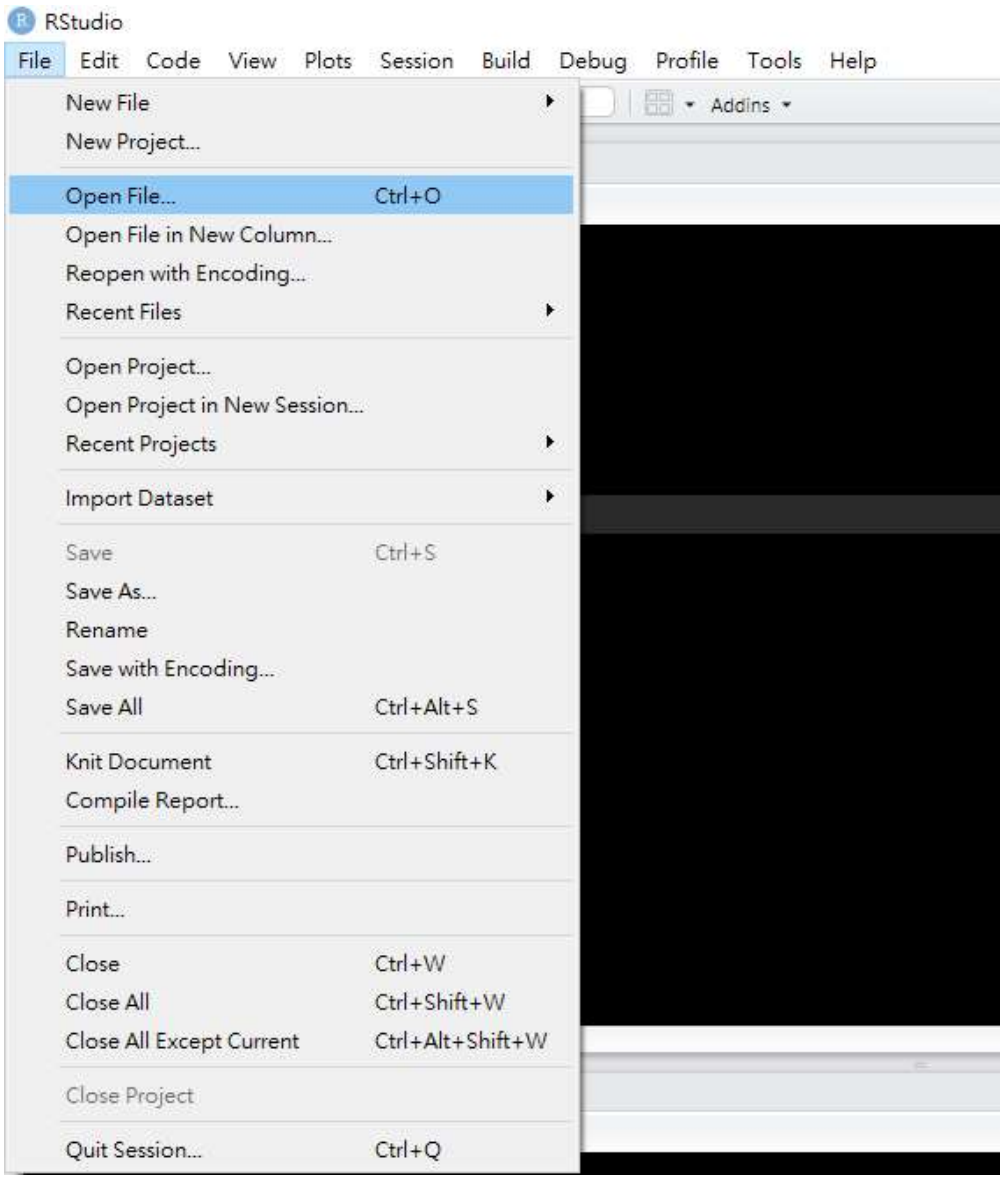
Name	Description	Version
User Library		
abind	Combine Multidimensional Arrays	1.4-5
assertthat	Easy Pre and Post Assertions	0.2.1
backports	Reimplementations of Functions Introduced Since R-3.0.0	1.2.1
BH	Boost C++ Header Files	1.75.0-0
broom	Convert Statistical Objects into Tidy Tibbles	0.7.5
car	Companion to Applied Regression	3.0-10
carData	Companion to Applied Regression Data Sets	3.0-4
cellranger	Translate Spreadsheet Cell Ranges to Rows and Columns	1.1.0
cli	Helpers for Developing Command Line Interfaces	2.3.0
clipr	Read and Write from the System Clipboard	0.7.1
conquer	Convolution-Type Smoothed Quantile Regression	1.0.2
cpp11	A C++11 Interface for R's C Interface	0.2.6
crayon	Colored Terminal Output	1.4.0
curl	A Modern and Flexible Web Client for R	4.3
data.table	Extension of `data.frame`	1.14.0
digest	Create Compact Hash Digests of R Objects	0.6.27
dplyr	A Grammar of Data Manipulation	1.0.4
ellipsis	Tools for Working with ...	0.3.1
evaluate	Parsing and Evaluation Tools that Provide More Details than the Default	0.14
fansi	ANSI Control Sequence Aware String Functions	0.4.2
forcats	Tools for Working with Categorical Variables (Factors)	0.5.1

4. 儲存程式碼

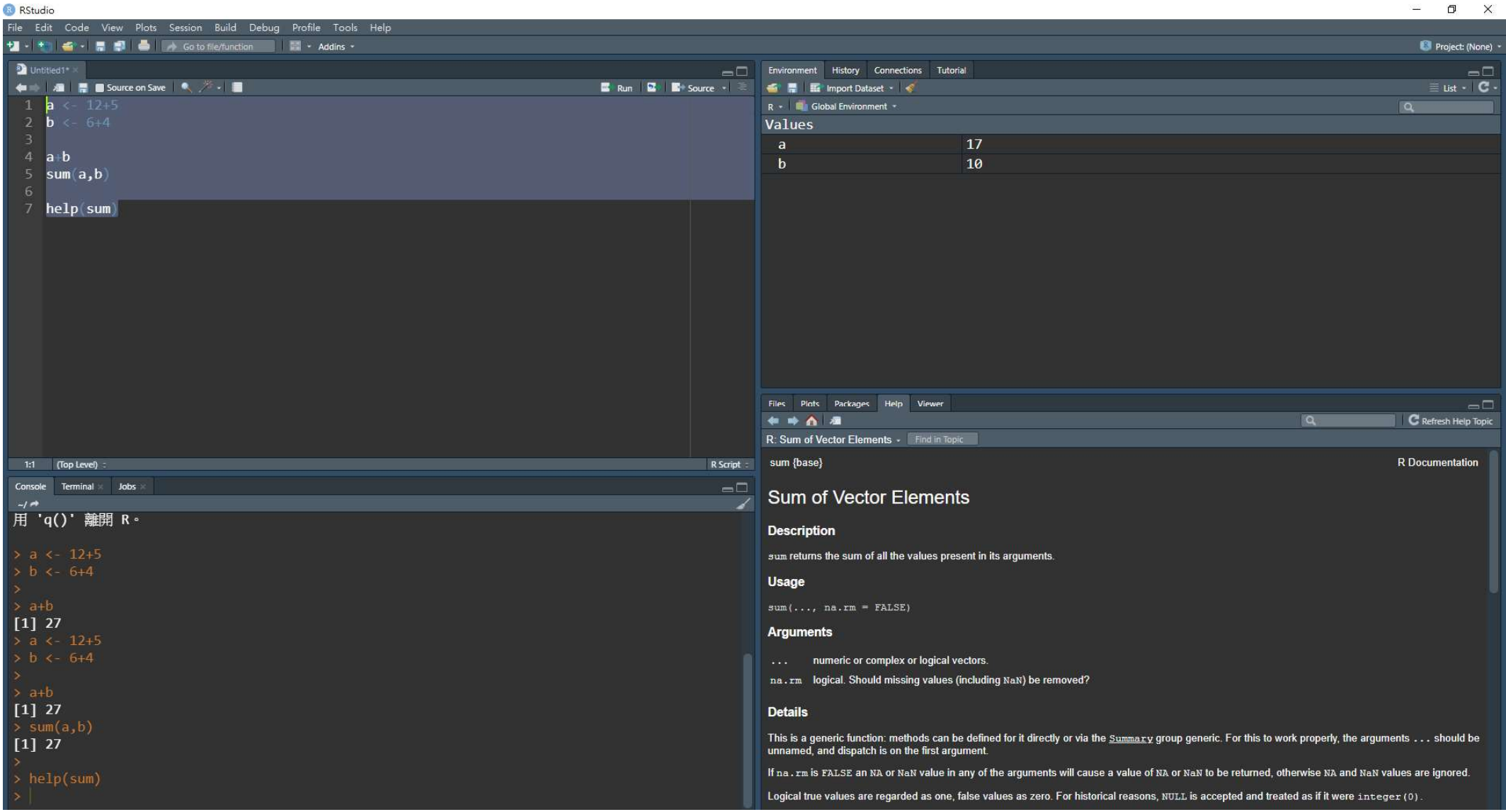

RStudio
File Edit Code View Plots Session
Untitled1*
Source on Save
Save current document (Ctrl+S)
1
a+b
sum(a,b)
help(sum)
Save File - Untitled1
« DATA (D:) › Dropbox › I JUNG › 中山大學 課程 › 109-2 R › R_WEEK1
搜尋 R_WEEK1
組合管理
新增資料夾
名稱
修改日期
類型
大小
R Programming for Biomedical Data 2021/3/2 下午 12:01 Microsoft Power... 2,998 KB
R_1_test 2021/2/25 下午 03:59 R 檔案 1 KB
WEEK1 2021/2/25 上午 05:53 Microsoft Word ... 18 KB
檔案名稱(N):
存檔類型(T): All Files
隱藏資料夾
Save
取消
2
3. 檔名確認
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
R_2_test.R
Source on Save
Run
Source
1 a <- 12+5
2 b <- 6+4
3

5. 開啟舊 R script 檔案

File >> Open File

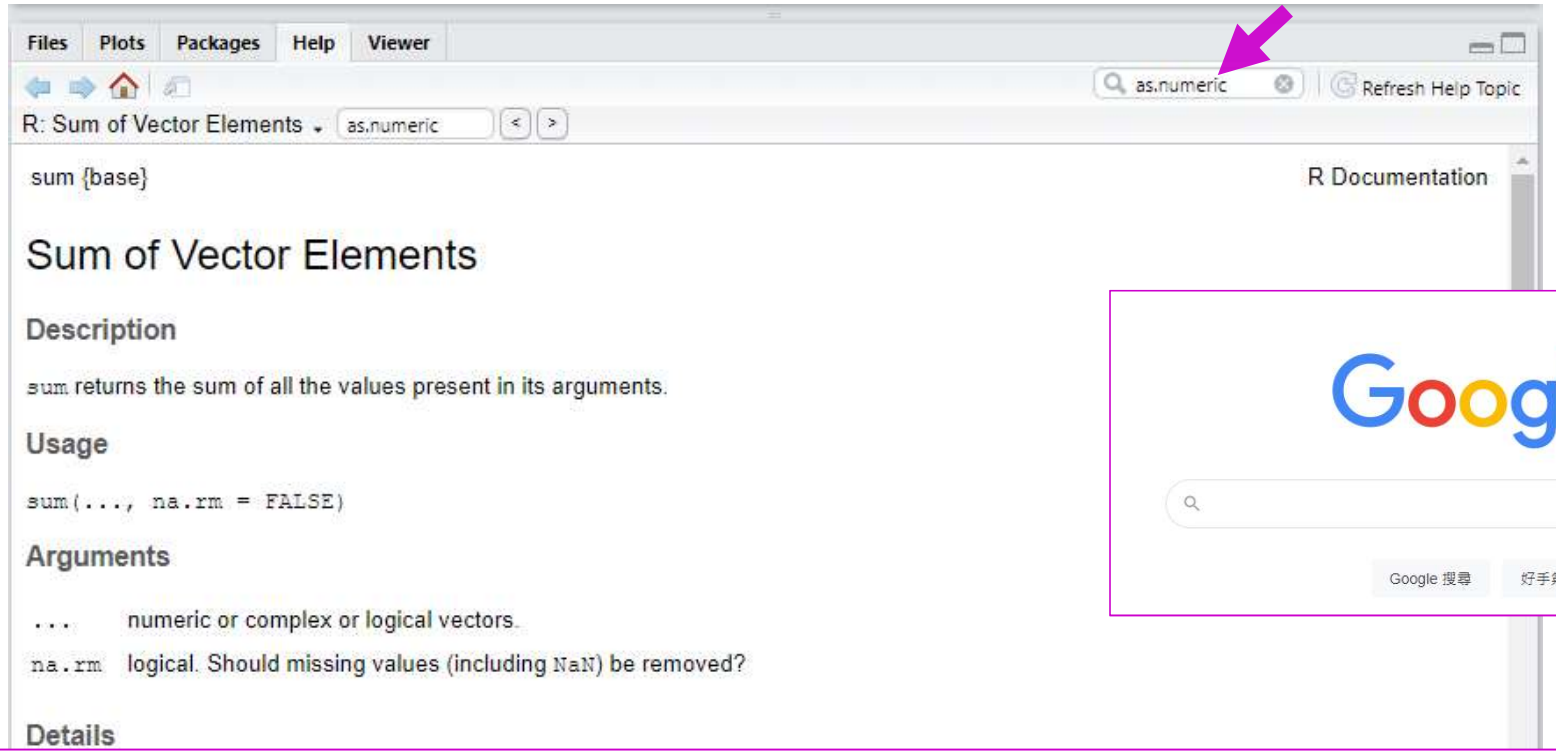


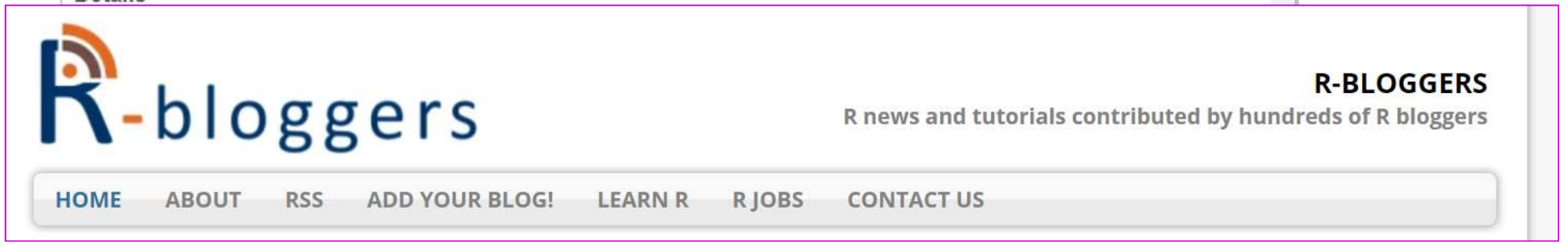
Coding Exercises: 1. 開啟新檔 2. 撰寫程式 3. 執行程式 4. 儲存程式 5. 開啟舊檔



Ways to Get Help in R

- *help(sum)*
- *?sum*





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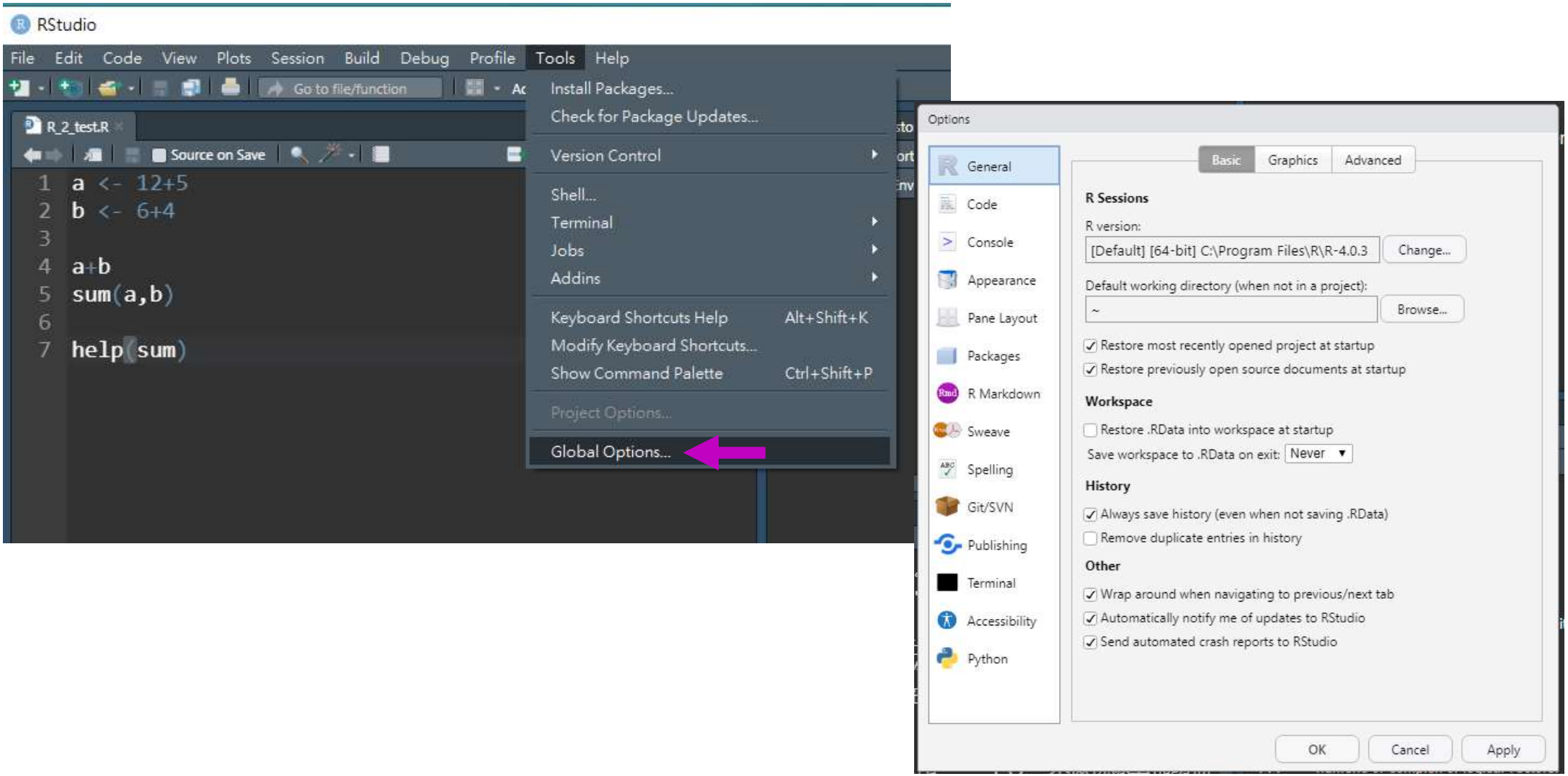
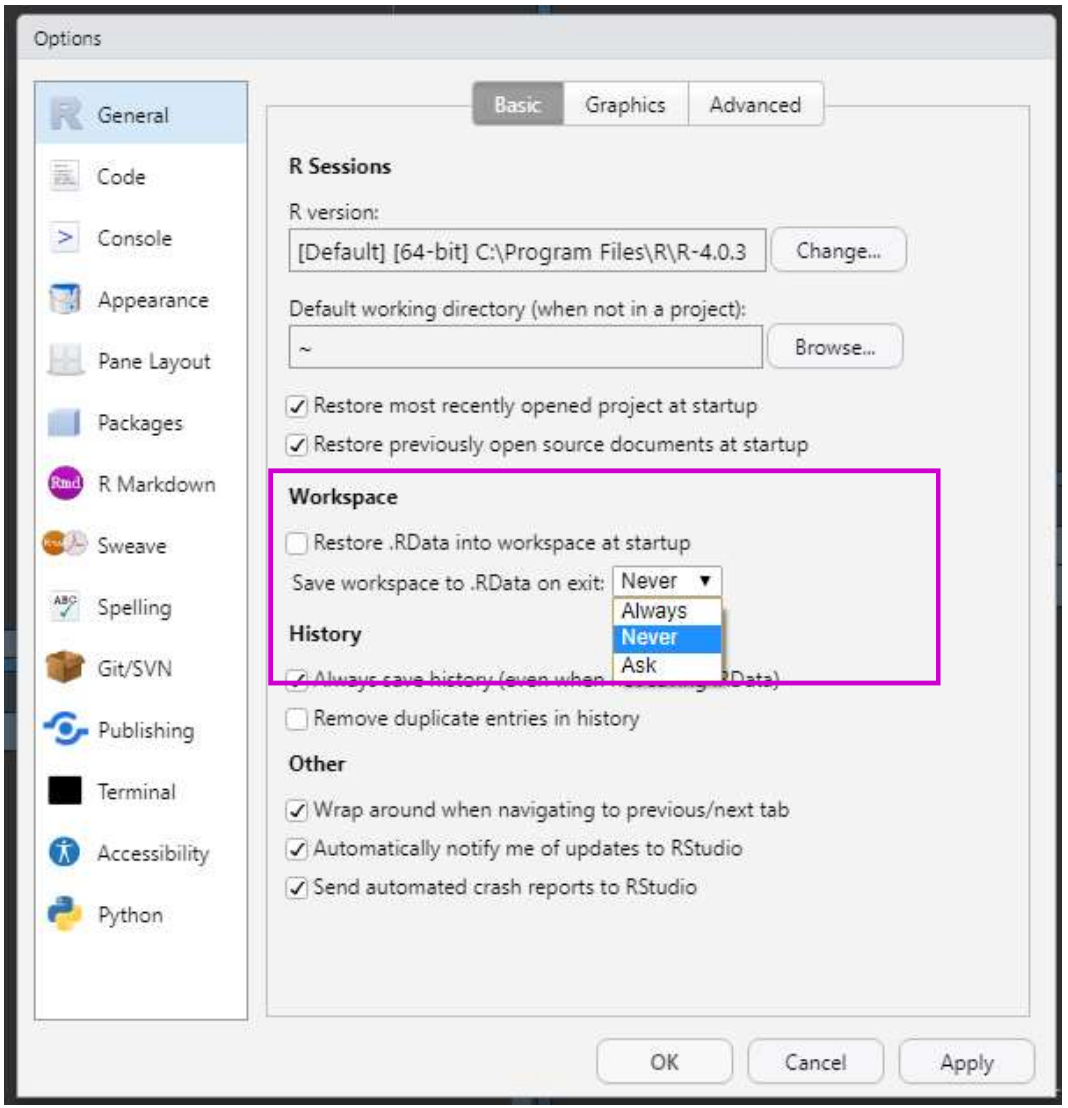
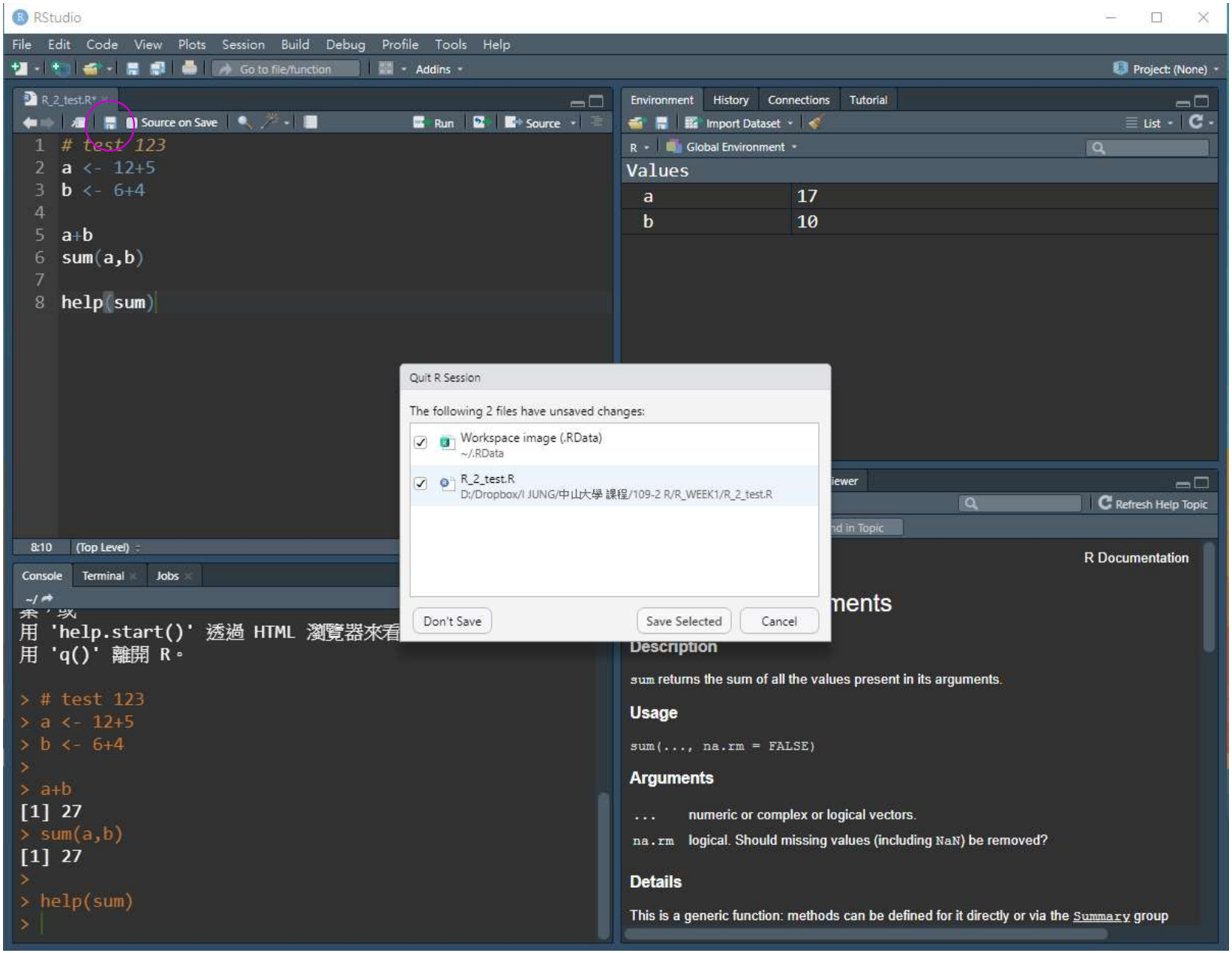
Tools >> Global Operations

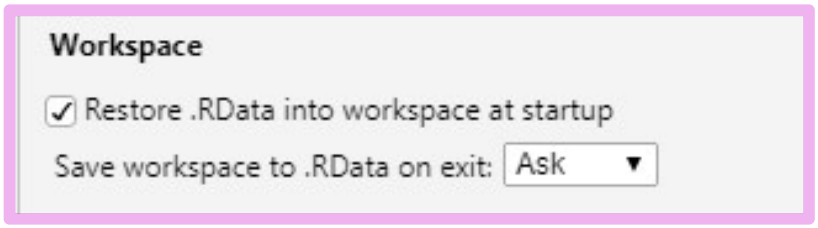


Tools >> Global Operations

- **General - Basic**



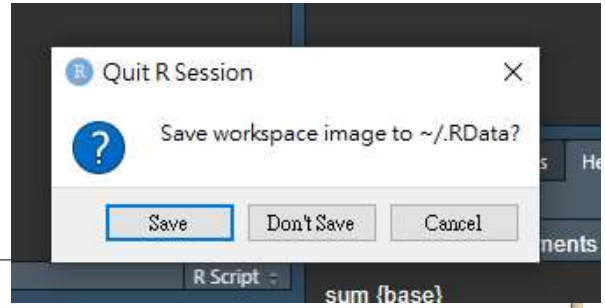

RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Project: (None)
R_2_test.R*
Source on Save
Run
Source
1 # test 123
2 a <- 12+5
3 b <- 6+4
4
5 a+b
6 sum(a,b)
7
8 help(sum)
8:10
(Top Level)
Console
Terminal
Jobs
用 'help.start()' 透過 HTML 瀏覽器來看
用 'q()' 離開 R。
> # test 123
> a <- 12+5
> b <- 6+4
>
> a+b
[1] 27
> sum(a,b)
[1] 27
>
> help(sum)
>
Environment
History
Connections
Tutorial
Import Dataset
List
R
Global Environment
Values
a 17
b 10
Quit R Session
The following 2 files have unsaved changes:
Workspace image (.RData)
~/.RData
R_2_test.R
D:/Dropbox/I JUNG/中山大學 課程/109-2 R/R_WEEK1/R_2_test.R
Don't Save
Save Selected
Cancel
Refresh Help Topic
R Documentation
Description
sum returns the sum of all the values present in its arguments.
Usage
sum(..., na.rm = FALSE)
Arguments
... numeric or complex or logical vectors.
na.rm logical. Should missing values (including NaN) be removed?
Details
This is a generic function: methods can be defined for it directly or via the Summary group

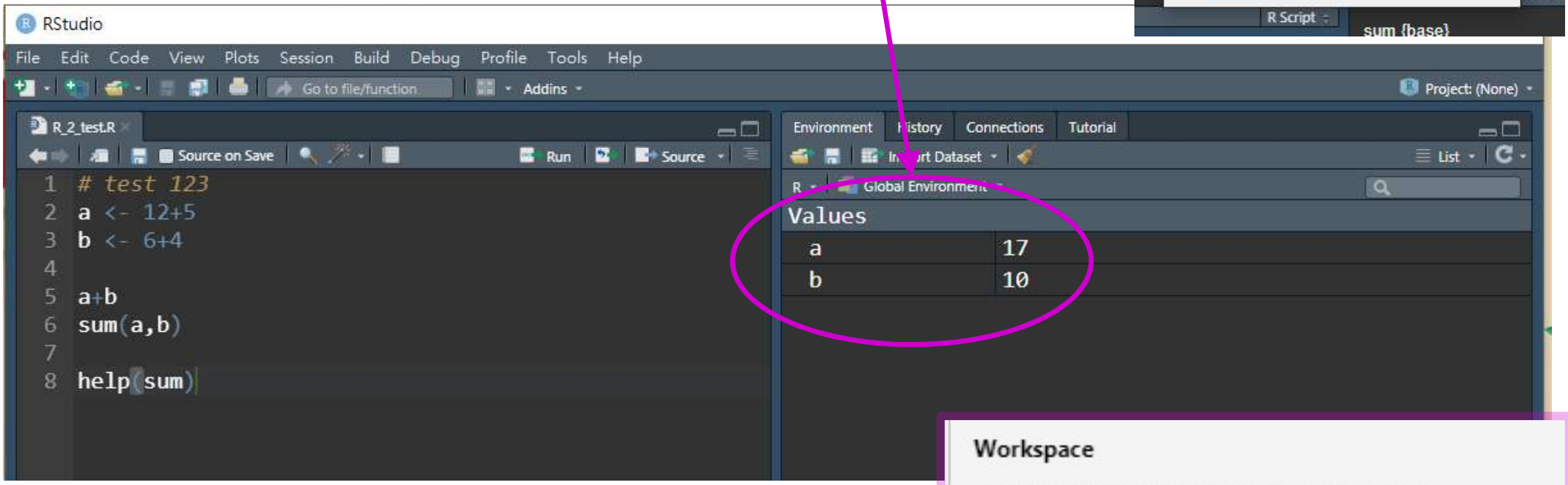


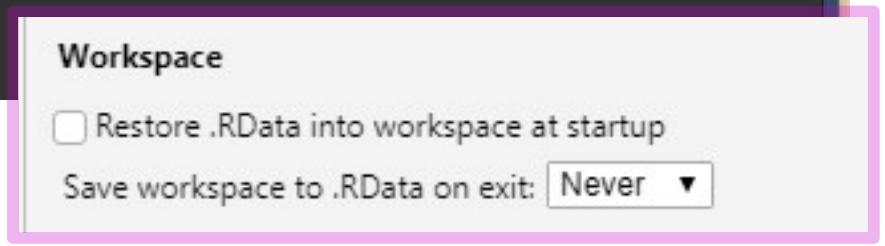
- 開啟時**是否恢復**workspace資料

關閉軟體 → 再開啟 → **存有紀錄**

- **是否儲存**目前 workspace 資料設定

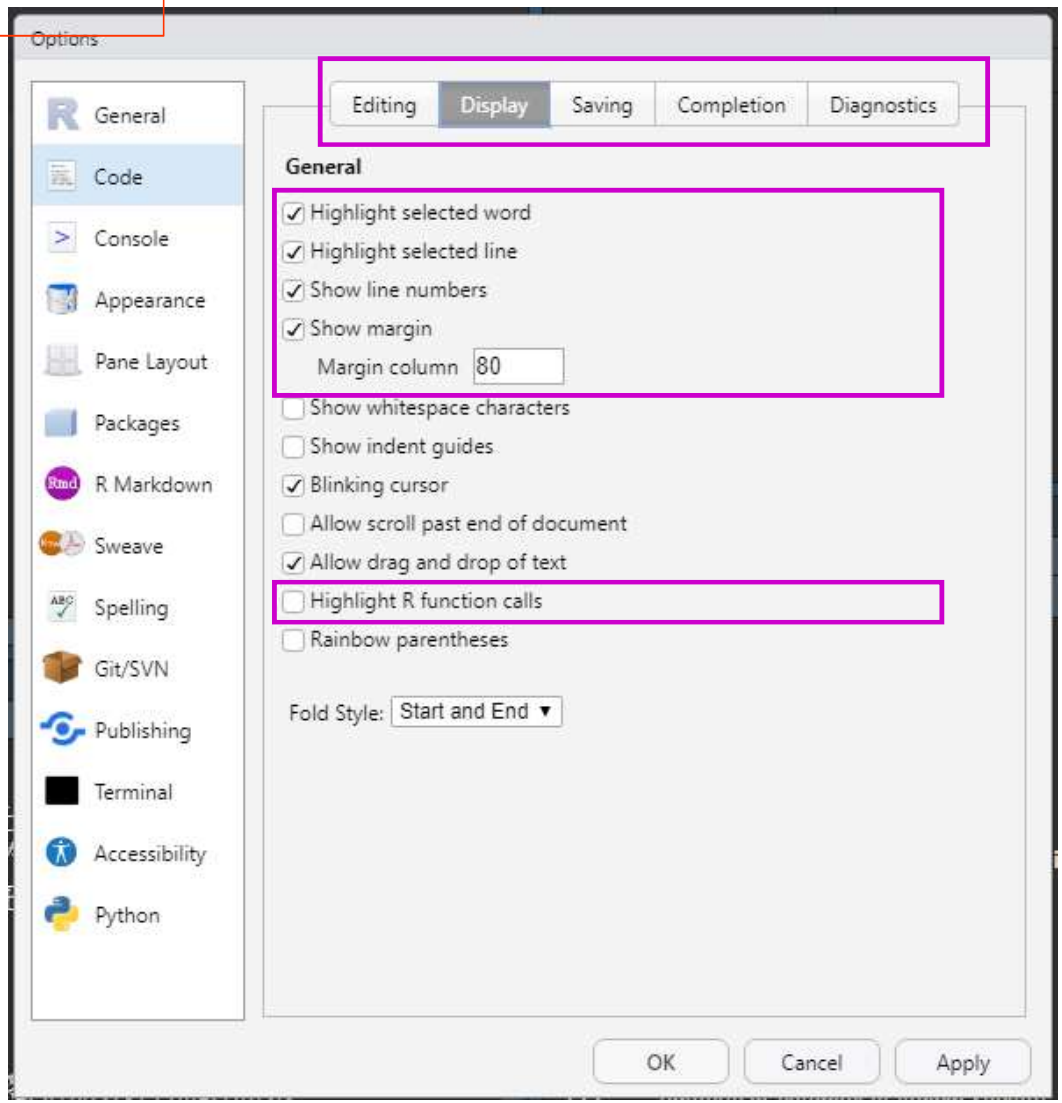


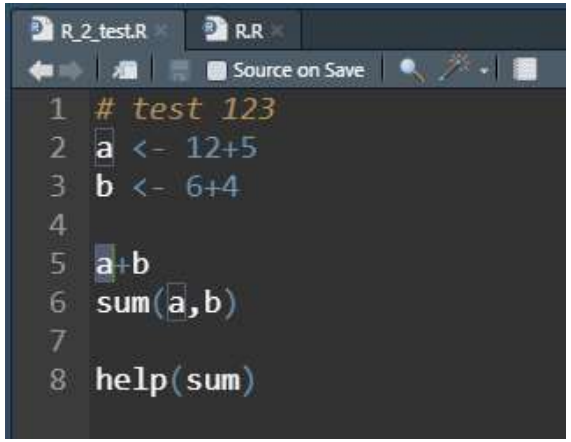


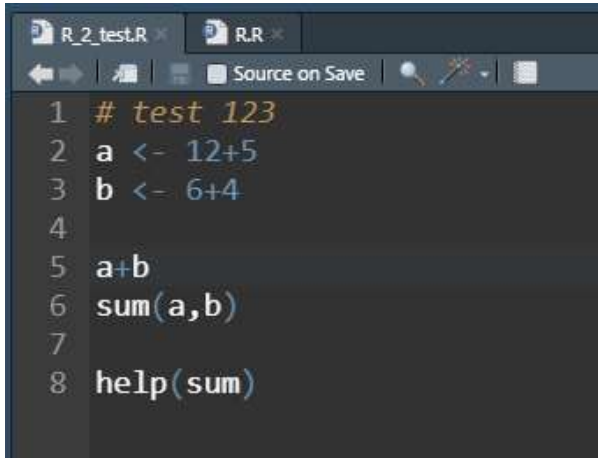


Tools >> Global Operations

- **Code – Display**

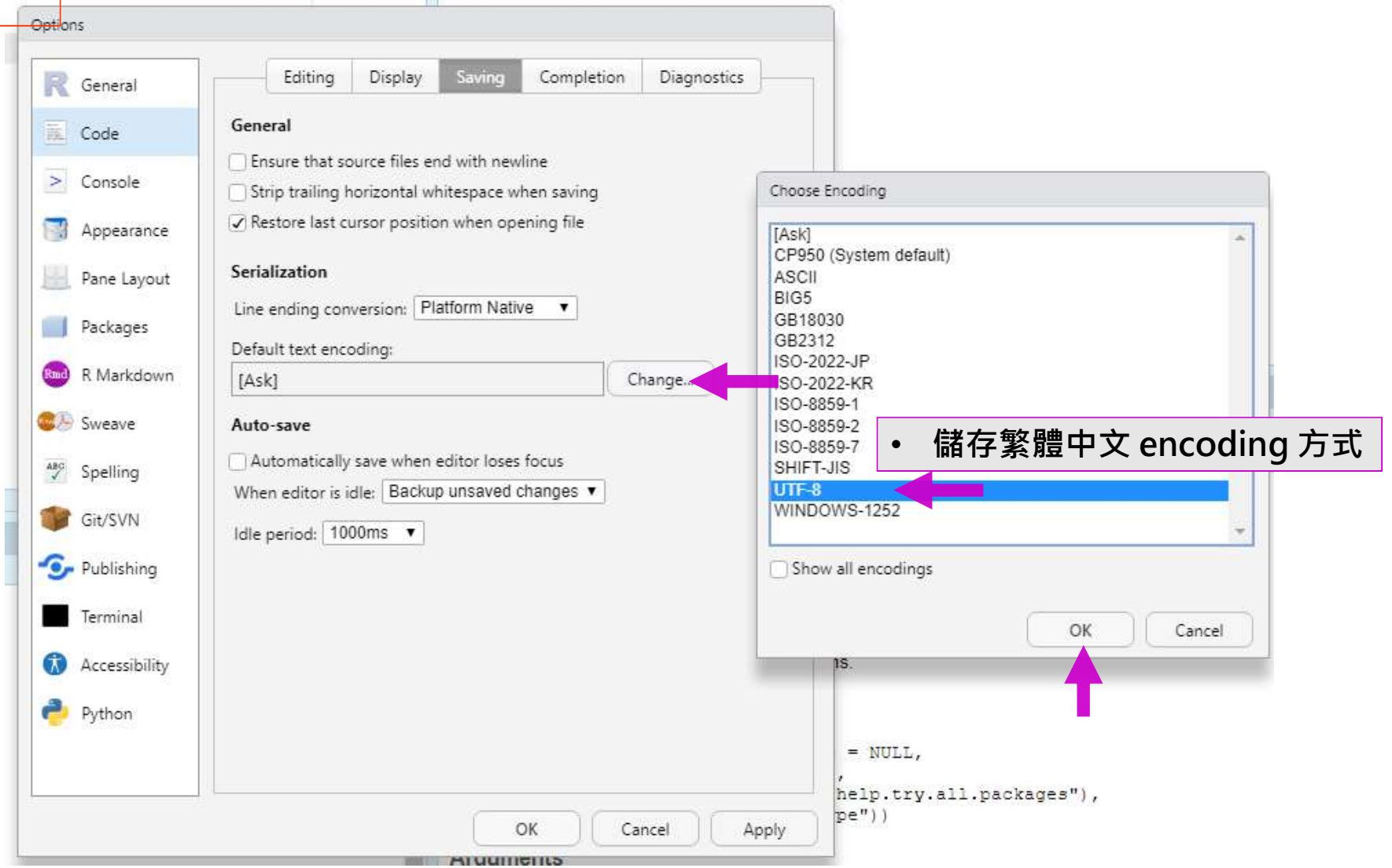




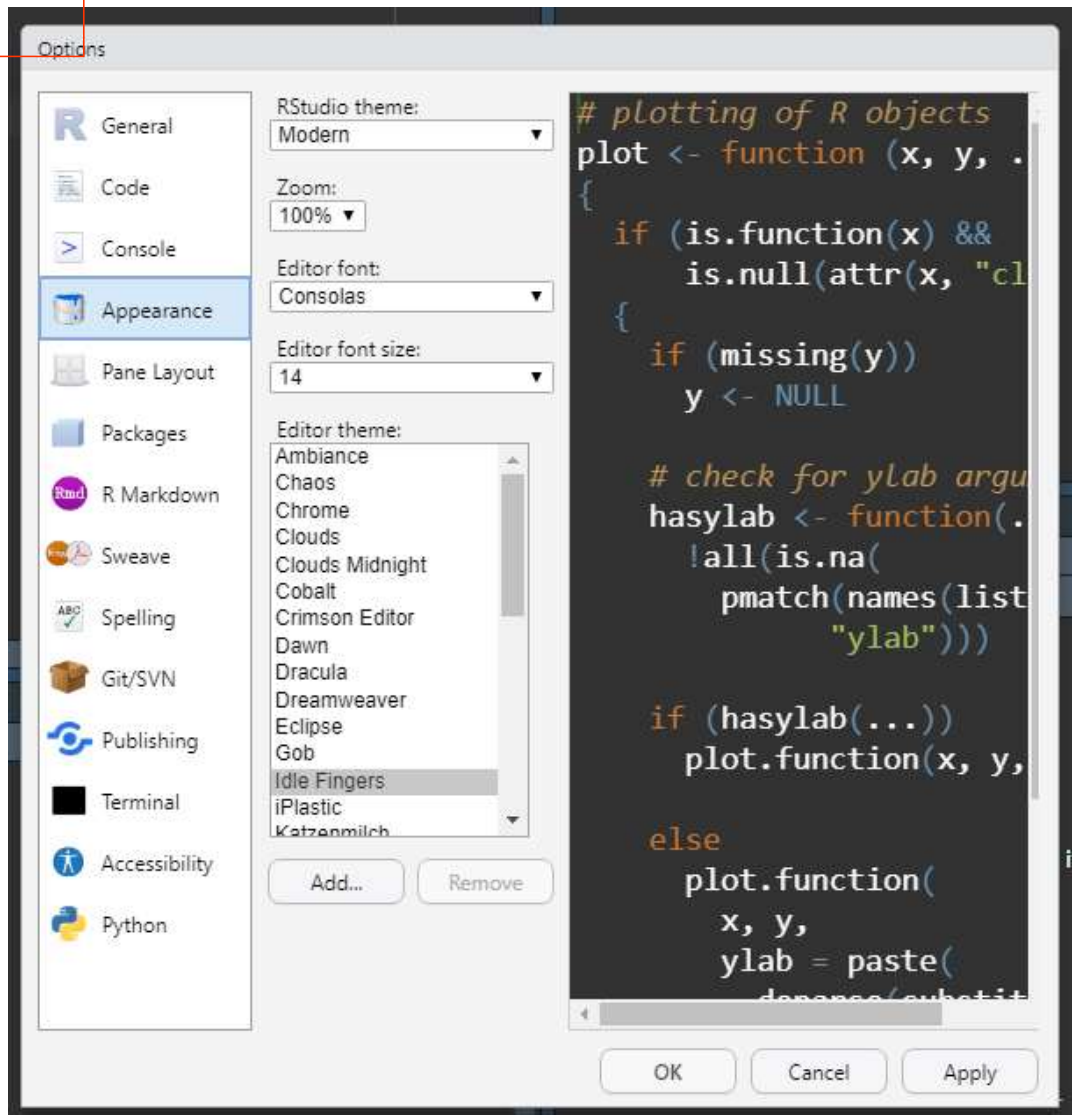


Tools >> Global Operations

- **Code – Saving**



Tools >> Global Operations
Appearance



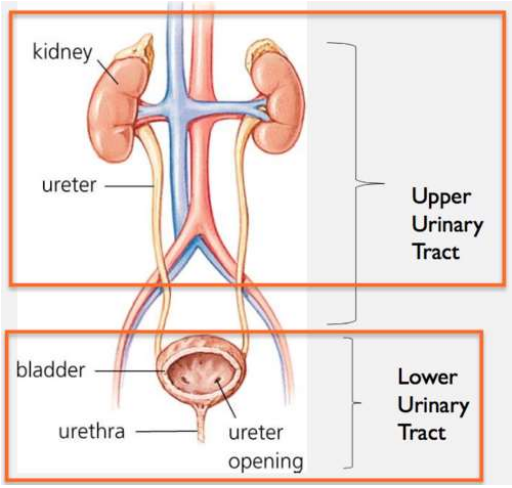
Tools >> Global Operations

1. General
2. Code
3. Appearance

實作 Practice

Acute Inflammations Data Set

J.Czerniak, H.Zarzycki, Application of rough sets in the presumptive diagnosis of urinary system diseases, Artifical Inteligence and Security in Computing Systems, ACS'2002 9th International Conference Proceedings, Kluwer Academic Publishers,2003, pp. 41-51



腎盂腎炎
Nephritis of renal pelvis origin

- 常發生在女性
- 突然高燒，體溫常超過40°C
- 高燒伴隨顫抖、雙邊或單側的腰椎異常疼痛
- 排尿疼痛
- 可能不規律的發生噁心、嘔吐、腹部疼痛

急性膀胱炎
Inflammation of urinary bladder

- 突發性腹部疼痛
- 常見排尿困難、排尿疼痛、頻尿
- 體溫升高，但常不超過38°C
- 排出尿液混濁，有時會有血尿

資料整理

{共120個觀察值, 6個變項, 其中一個連續型變項, 5個類別變項}

Temperature 體溫	Nausea 噁心	Lumbar pain 腰椎痛	Urine pushing 排尿困難	Micturition pains 排尿疼痛	Burning of urethra 尿道灼熱, 搔癢
35,5	no	yes	no	no	no
35,9	no	no	yes	yes	yes
35,9	no	yes	no	no	no
36,0	no	no	yes	yes	yes
36,0	no	yes	no	no	no

Coding book 譯碼簿

變項編號	變項英文名稱	變項中文名稱	單位	
V1	Temperature	體溫	℃	連續變項
V2	nausea	噁心		0:無(no) 1:有(yes)
V3	Lumbar pain	腰椎痛		0:無(no) 1:有(yes)
V4	Urine pushing	排尿困難		0:無(no) 1:有(yes)
V5	Micturition pains	排尿疼痛		0:無(no) 1:有(yes)
V6	Burning of urethra	尿道灼熱, 搔癢		0:無(no) 1:有(yes)

Alt+Enter : 下一行

資料整理

{共120個觀察值, 6個變項, 其中一個連續型變項, 5個類別變項}

Temperature 體溫	Nausea 噁心	Lumbar pain 腰椎痛	Urine pushing 排尿困難	Micturition pains 排尿疼痛	Burning of urethra 尿道灼熱, 搔癢
35,5	no	yes	no	no	no
35,9	no	no	yes	yes	yes
35,9	no	yes	no	no	no
36,0	no	no	yes	yes	yes
36,0	no	yes	no	no	no

,	→	.
yes	→	1
no	→	0

AND、OR、NOT

Temperature 體溫	Nausea 噁心	Lumbar pain 腰椎痛	Urine pushing 排尿困難	Micturition pains 排尿疼痛	Burning of urethra 尿道灼熱, 搔癢
35,5	no	yes	no	no	no
35,9	no	no	yes	yes	yes
35,9	no	yes	no	no	no
36,0	no	no	yes	yes	yes
36,0	no	yes	no	no	no

腎盂腎炎
Nephritis of renal pelvis origin

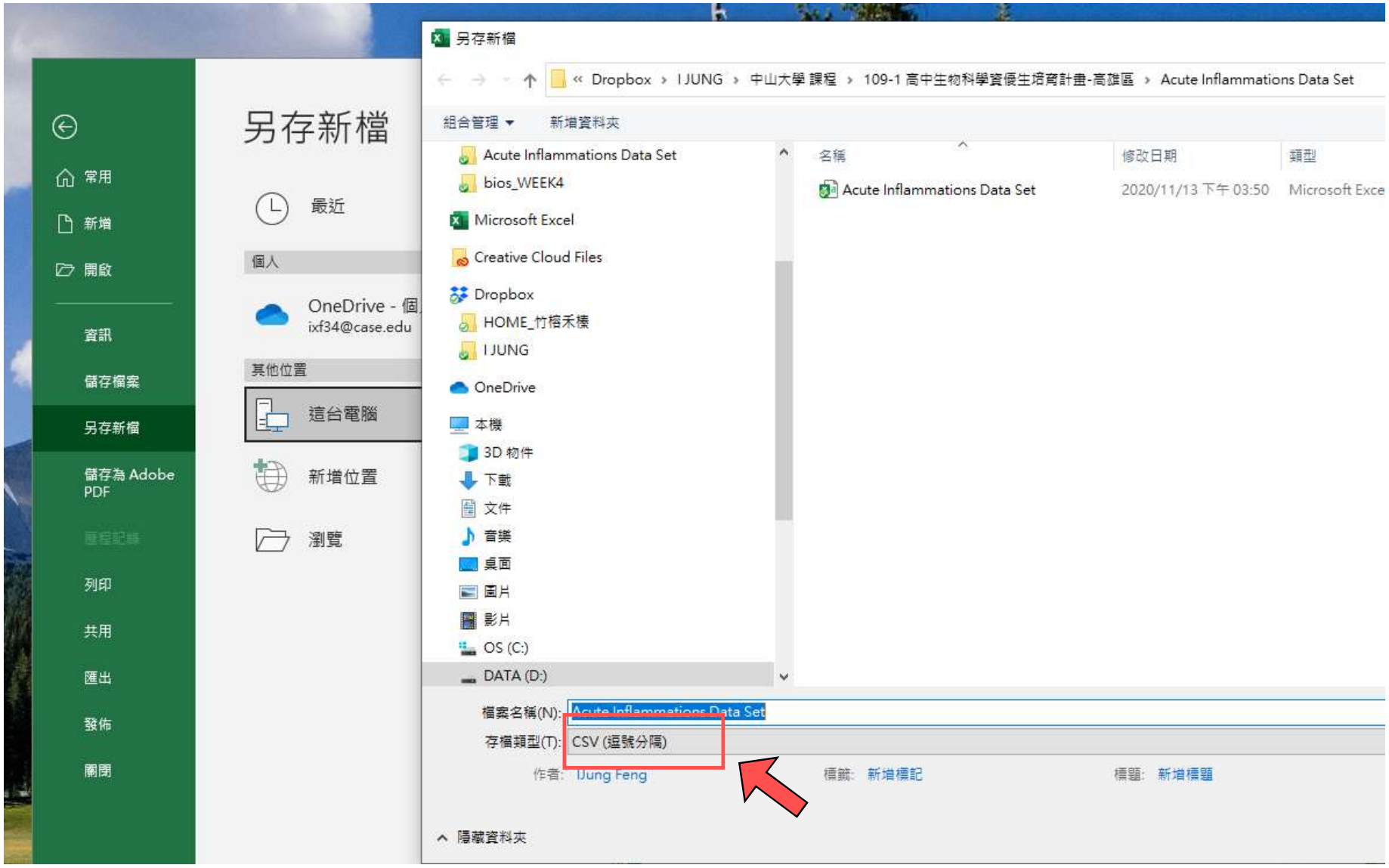
- 常發生在**女性**
- 突然**高燒**，體溫常超過40°C
- 高燒伴隨顫抖、雙邊或單側的**腰椎異常疼痛**
- **排尿疼痛**
- 可能不規律的發生噁心、嘔吐、腹部疼痛

急性膀胱炎
Inflammation of urinary bladder

- 突發性**腹部疼痛**
- 常見**排尿困難**、**排尿疼痛**、頻尿
- 體溫升高，但**常不超過38°C**
- 排出尿液混濁，有時會有血尿

Cystitis_1
排尿困難**且**排尿疼痛

Cystitis_2
排尿困難**或**排尿疼痛**或**尿道灼熱


另存新檔
常用
新增
開啟
資訊
儲存檔案
另存新檔
儲存為 Adobe PDF
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共用
匯出
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關閉
另存新檔
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OneDrive - 個
ixf34@case.edu
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瀏覽
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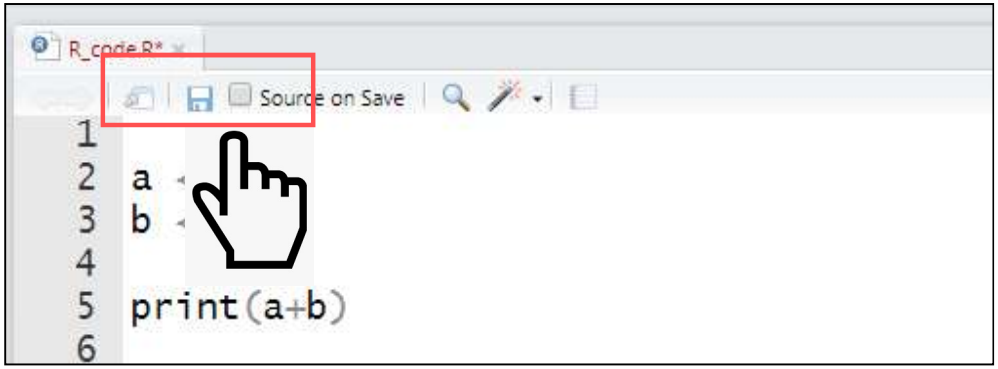
« Dropbox › I JUNG › 中山大學 課程 › 109-1 高中生物科學資優生培育計畫-高雄區 › Acute Inflammations Data Set
組合管理
新增資料夾
Acute Inflammations Data Set
bios_WEEK4
Microsoft Excel
Creative Cloud Files
Dropbox
HOME_竹榕禾積
I JUNG
OneDrive
本機
3D 物件
下載
文件
音樂
桌面
圖片
影片
OS (C:)
DATA (D:)
名稱
修改日期
類型
Acute Inflammations Data Set
2020/11/13 下午 03:50
Microsoft Exce
檔案名稱(N): Acute Inflammations Data Set
存檔類型(T): CSV (逗號分隔)
作者: IJung Feng
標籤: 新增標記
標題: 新增標題
隱藏資料夾

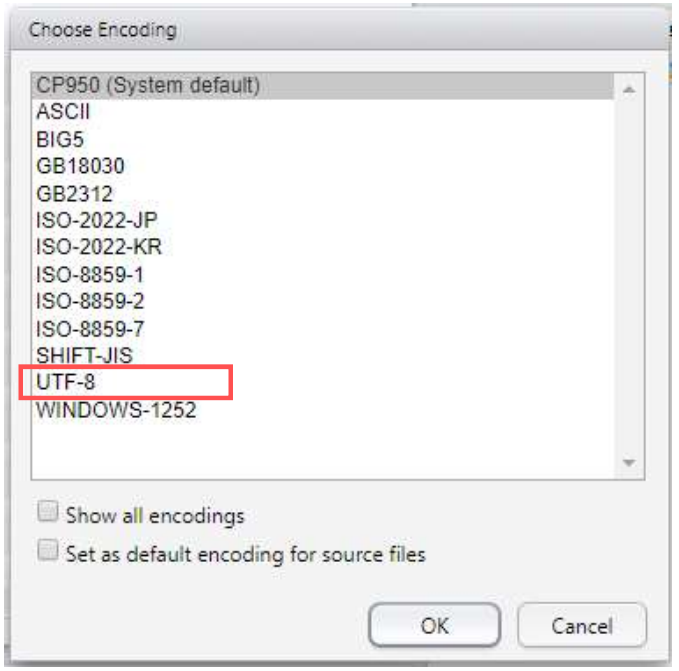

R_code.R
Source on Save
Run
Source
1
2 a <- 3
3 b <- 6
4
5 print(a+b)
6
7


R_code.R
Source on Save
Run
Source
1
2 a <- 3
3 b <- 6
4
5 print(a+b)
6
7
8

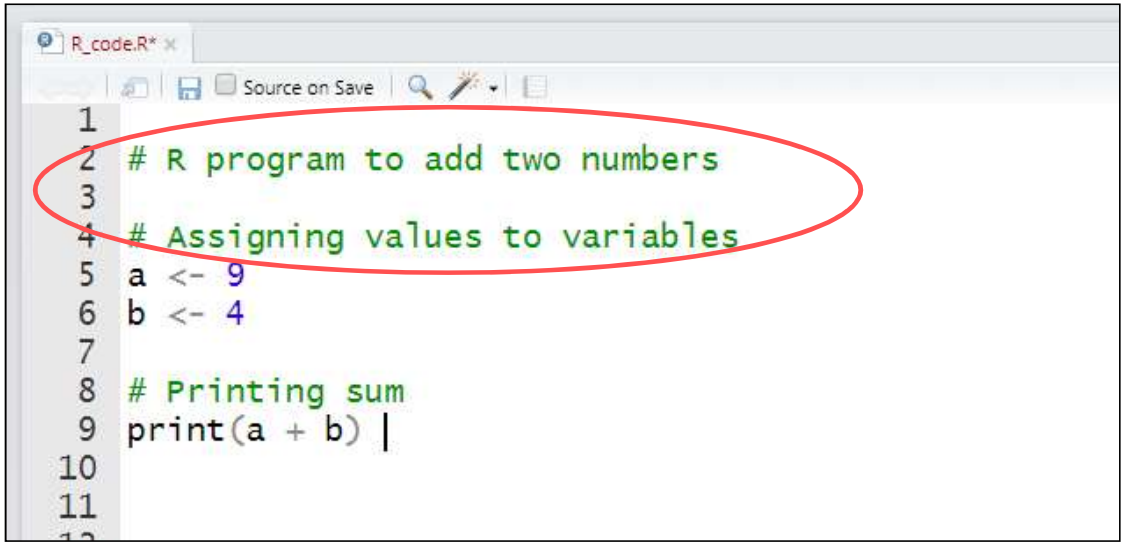

Console
Terminal
Jobs
D:/Dropbox/I JUNG/中山大學 課程/109-1 高中生物科學資優生培育計畫-高雄區/
> a <- 3
> b <- 6
>
> print(a+b)
[1] 9
>

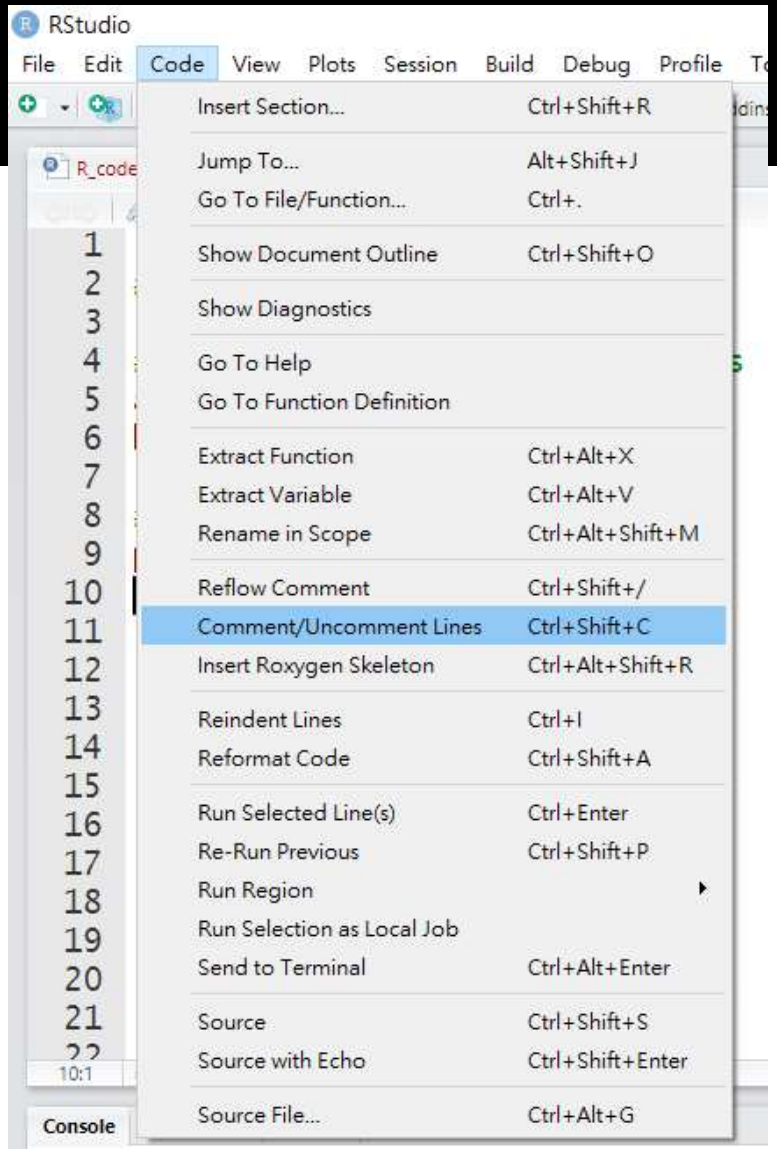
Save file


R_code.R*
Source on Save
1
2 a
3 b
4
5 print(a+b)
6


Choose Encoding
CP950 (System default)
ASCII
BIG5
GB18030
GB2312
ISO-2022-JP
ISO-2022-KR
ISO-8859-1
ISO-8859-2
ISO-8859-7
SHIFT-JIS
UTF-8
WINDOWS-1252
Show all encodings
Set as default encoding for source files
OK
Cancel

Add comment


R_code.R*
Source on Save
# R program to add two numbers
# Assigning values to variables
a <- 9
b <- 4
# Printing sum
print(a + b)


RStudio
File Edit Code View Plots Session Build Debug Profile
Insert Section... Ctrl+Shift+R
Jump To... Alt+Shift+J
Go To File/Function... Ctrl+.
Show Document Outline Ctrl+Shift+O
Show Diagnostics
Go To Help
Go To Function Definition
Extract Function Ctrl+Alt+X
Extract Variable Ctrl+Alt+V
Rename in Scope Ctrl+Alt+Shift+M
Reflow Comment Ctrl+Shift+/
Comment/Uncomment Lines Ctrl+Shift+C
Insert Roxygen Skeleton Ctrl+Alt+Shift+R
Reindent Lines Ctrl+I
Reformat Code Ctrl+Shift+A
Run Selected Line(s) Ctrl+Enter
Re-Run Previous Ctrl+Shift+P
Run Region
Run Selection as Local Job
Send to Terminal Ctrl+Alt+Enter
Source Ctrl+Shift+S
Source with Echo Ctrl+Shift+Enter
Source File... Ctrl+Alt+G
10:1
Console

Set working directory. Read data.

R_code.R* ×

Source on Save | Run | Source

```
1
2  # First, set your working directory
3  setwd("D:/Dropbox/I JUNG/中山大學 課程/109-1 高中生物科學資優生培育計畫-高雄區/")
4
5  # Import the data and look at the first six rows
6  mydata <- read.csv(file = 'data/Acute Inflammations Data Set.csv')
7  head(mydata)
8  names(mydata)
```

D:/Dropbox/I JUNG/中山大學 課程/109-1 高中生物科學資優生培育計畫-高雄區/

```
> # First, set your working directory
> setwd("D:/Dropbox/I JUNG/中山大學 課程/109-1 高中生物科學資優生培育計畫-高雄區/")
>
> # Import the data and look at the first six rows
> mydata <- read.csv(file = 'data/Acute Inflammations Data Set.csv')
> head(mydata)
  Temperature nausea Lumbar.pain Urine.pushing Micturition.pains Burning.of.urethra
1        35.5     no         yes            no                no                no
2        35.9     no          no           yes               yes               yes
3        35.9     no         yes            no                no                no
4        36.0     no          no           yes               yes               yes
5        36.0     no         yes            no                no                no
6        36.0     no         yes            no                no                no
```

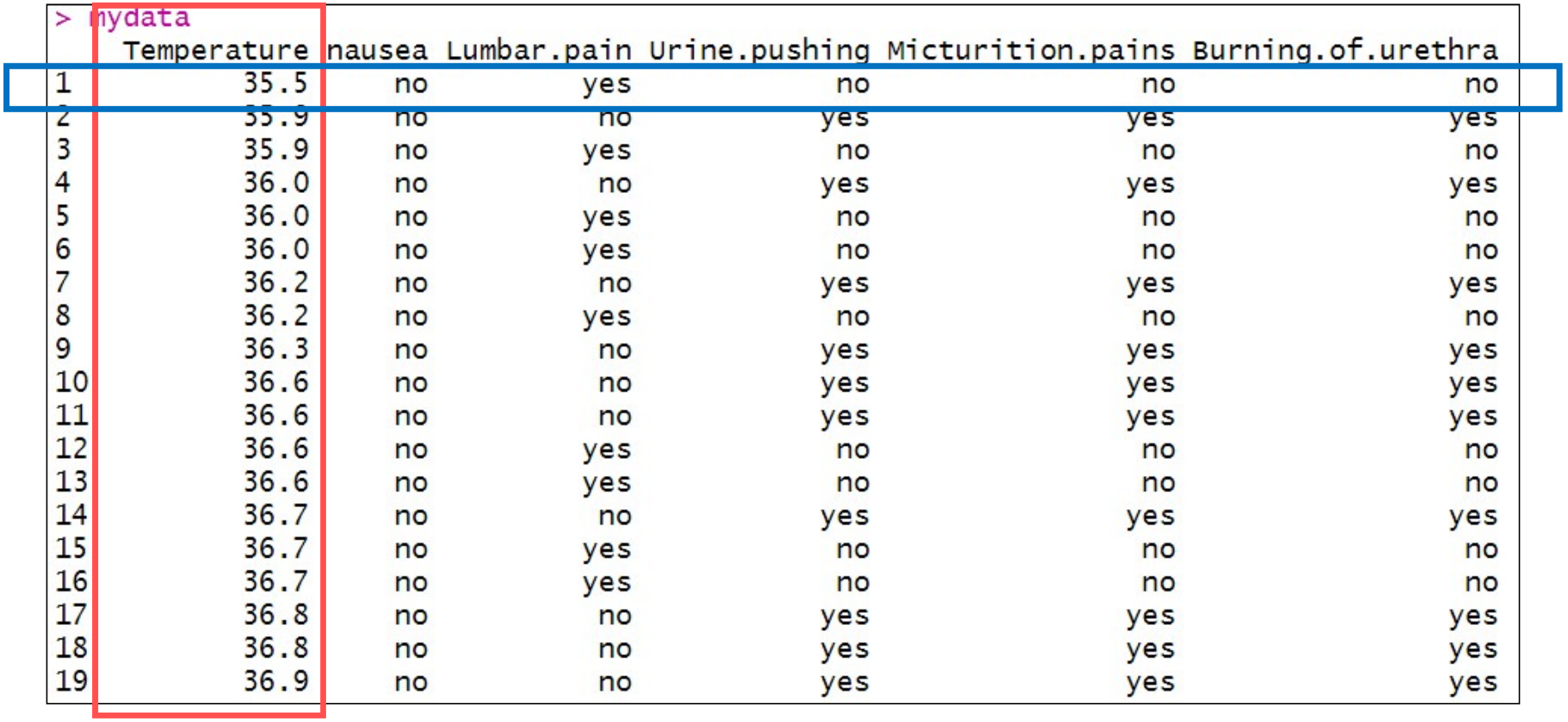
Description	Windows & Linux	Mac
Clear console	Ctrl+L	Ctrl+L

No. of variables. No. of observations.

Column?
Row?

觀察值
observations

變項 variables



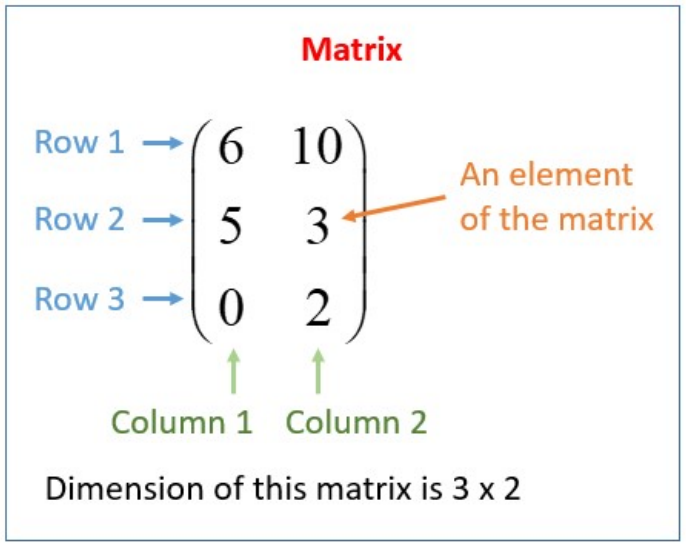
```
> mydata
   Temperature nausea Lumbar.pain Urine.pushing Micturition.pains Burning.of.urethra
1         35.5     no         yes            no                no                 no
2         35.9     no          no           yes               yes                yes
3         35.9     no         yes            no                no                 no
4         36.0     no          no           yes               yes                yes
5         36.0     no         yes            no                no                 no
6         36.0     no         yes            no                no                 no
7         36.2     no          no           yes               yes                yes
8         36.2     no         yes            no                no                 no
9         36.3     no          no           yes               yes                yes
10        36.6     no          no           yes               yes                yes
11        36.6     no          no           yes               yes                yes
12        36.6     no         yes            no                no                 no
13        36.6     no         yes            no                no                 no
14        36.7     no          no           yes               yes                yes
15        36.7     no         yes            no                no                 no
16        36.7     no         yes            no                no                 no
17        36.8     no          no           yes               yes                yes
18        36.8     no          no           yes               yes                yes
19        36.9     no          no           yes               yes                yes
```

No. of variables. No. of observations.

Console Terminal Jobs

D:/Dropbox/I JUNG/中山大學 課程/109-1 高中生物科學資優生培育計畫-高雄區/

```
> # method 1
> nrow(mydata)
[1] 120
> colnames(mydata)
[1] "Temperature"        "nausea"             "Lumbar.pain"        "Urine.pushing"      "Micturition.pains"
[6] "Burning.of.urethra"
> ncol(mydata)
[1] 6
>
> # method 2
> dim(mydata)
[1] 120   6
>
```




```
> mydata
    Temperature nausea Lumbar.pain Urine.pushing Micturition.pains Burning.of.urethra
1          35.5     no          yes            no                no                 no
2          35.9     no           no           yes               yes                yes
3          35.9     no          yes            no                no                 no
4          36.0     no           no           yes               yes                yes
5          36.0     no          yes            no                no                 no
6          36.0     no          yes            no                no                 no
7          36.2     no           no           yes               yes                yes
8          36.2     no          yes            no                no                 no
9          36.3     no           no           yes               yes                yes
10         36.6     no           no           yes               yes                yes
11         36.6     no           no           yes               yes                yes
12         36.6     no          yes            no                no                 no
13         36.6     no          yes            no                no                 no
14         36.7     no           no           yes               yes                yes
15         36.7     no          yes            no                no                 no
16         36.7     no          yes            no                no                 no
17         36.8     no           no           yes               yes                yes
18         36.8     no           no           yes               yes                yes
19         36.9     no           no           yes               yes                yes
```

Creating new variables.[ifelse()] [AND、OR、NOT]

ifelse(test_expression, x, y)

```
> a = c(5,7,2,9)
> ifelse(a %% 2 == 0,"even","odd")
[1] "odd"  "odd"  "even" "odd"
```

Arithmetic Operators

Operator	Description
+	addition
-	subtraction
*	multiplication
/	division
^ or **	exponentiation
x %% y	modulus (x mod y) 5%%2 is 1
x %/% y	integer division 5%/%2 is 2

Logical Operators

Operator	Description
<	less than
<=	less than or equal to
>	greater than
>=	greater than or equal to
==	exactly equal to
!=	not equal to
!x	Not x
x | y	x OR y
x & y	x AND y
isTRUE(x)	test if X is TRUE

Cystitis_1

排尿困難且排尿疼痛

=AND(D2=1,E2=1)

	A	C	D	E	F	G	H
1	Temperature	Lumbar pain	Urine pushing	Micturition pains	Burning of urethra	Cystitis_1	
2	35.5	1	0	0	0	=AND(D2=1,E2=1)	
3	35.9	0	1	1	1		
4	35.9	1	0	0	0		
5	36	0	1	1	1		

```r
# Creating new variables
# method 1
mydata$Cystitis_11 <- ifelse((mydata$Urine.pushing =="yes") & (mydata$Micturition.pains =="yes"), 1, 0)
head(mydata)
```

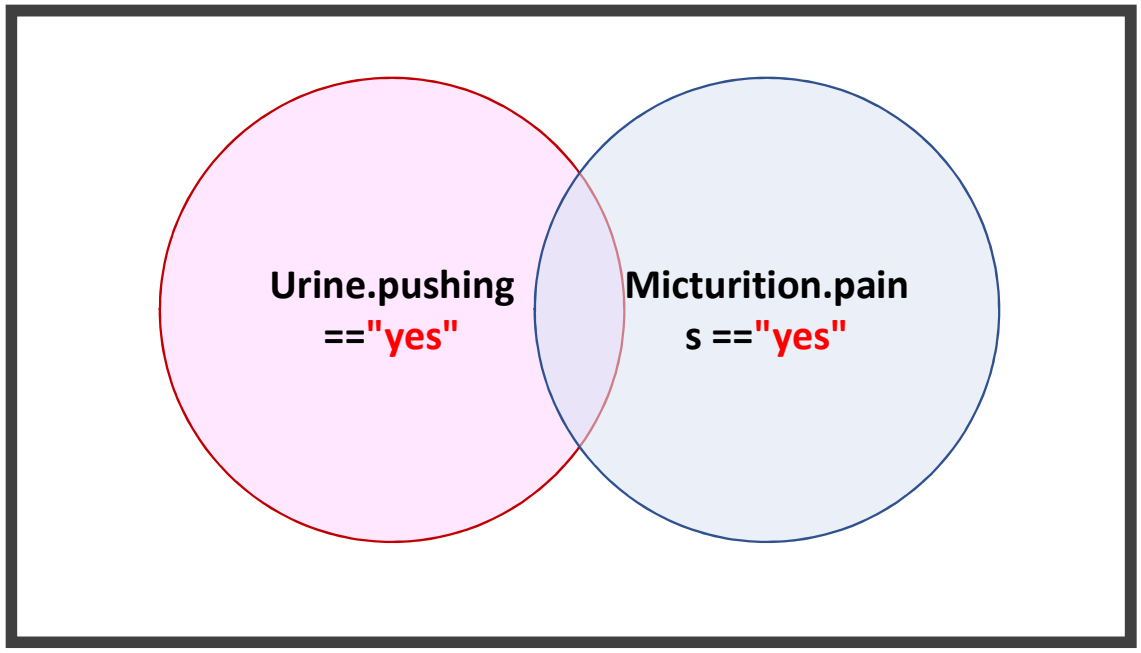
```
> head(mydata)
  Temperature nausea Lumbar.pain Urine.pushing Micturition.pains Burning.of.urethra Cystitis_11
1        35.5     no         yes            no                no                 no           0
2        35.9     no          no           yes               yes                yes           1
3        35.9     no         yes            no                no                 no           0
4        .0     no          no           yes               yes                yes           1
5        .0     no         yes            no                no                 no           0
6        .0     no         yes            no                no                 no           0
```

Logical Operators

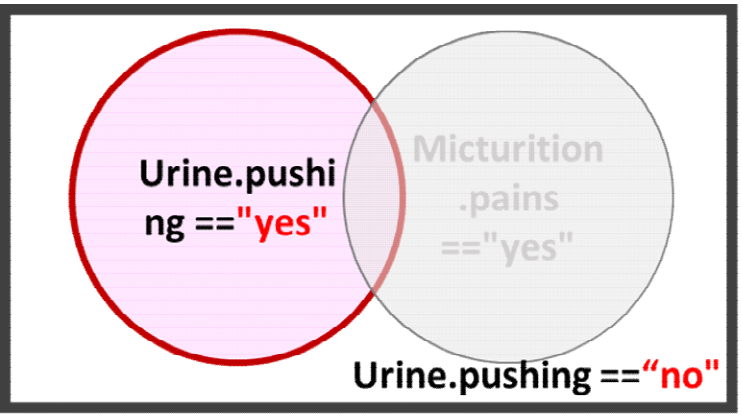
Operator	Description
<	less than
<=	less than or equal to
>	greater than
>=	greater than or equal to
==	exactly equal to
!=	not equal to
!x	Not x
x | y	x OR y
x & y	x AND y
isTRUE(x)	test if X is TRUE

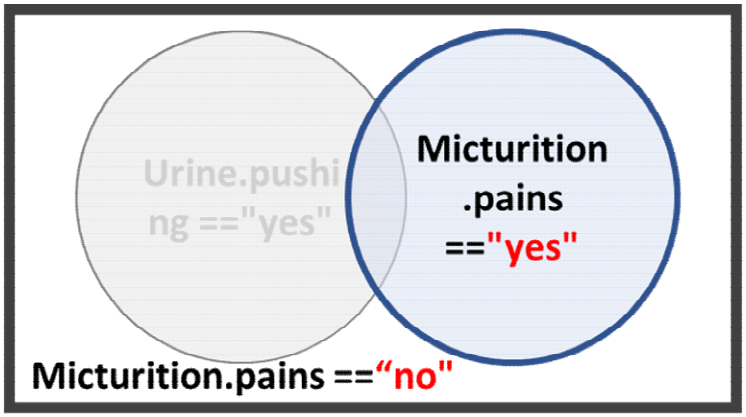
```
15 # method 2
16 attach(mydata)
17 mydata$Cystitis_12[(Urine.pushing =="yes")&(Micturition.pains =="yes")] <- 1
18 mydata$Cystitis_12[                                                    ] <- 0
19 detach(mydata)
20 head(mydata)
```

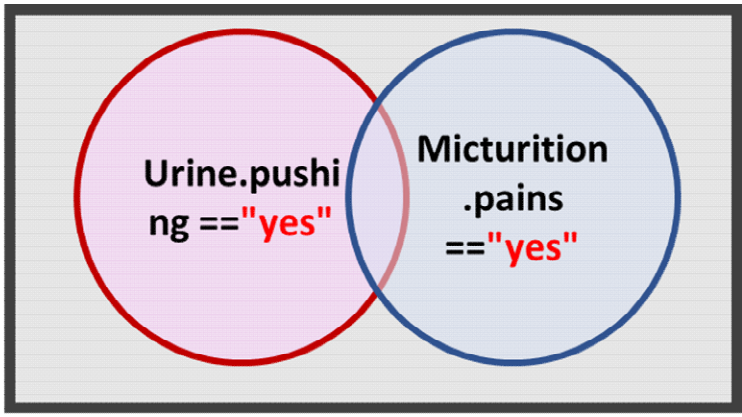
練習



```r
# method 2
attach(mydata)
mydata$Cystitis_12[(Urine.pushing =="yes")&(Micturition.pains =="yes")] <- 1
mydata$Cystitis_12[(Urine.pushing =="no")|(Micturition.pains =="no")] <- 0
detach(mydata)
head(mydata)
```







(Urine.pushing ==“no“) AND (Micturition.pains ==“no")

```
> head(mydata)
  Temperature nausea Lumbar.pain Urine.pushing Micturition.pains Burning.of.urethra Cystitis_11 Cystitis_12
1        35.5     no         yes            no                no                 no           0           0
2        35.9     no          no           yes               yes                yes           1           1
3        35.9     no         yes            no                no                 no           0           0
4        36.0     no          no           yes               yes                yes           1           1
5        36.0     no         yes            no                no                 no           0           0
6        36.0     no         yes            no                no                 no           0           0
```

No. of conditional observations.

```
29 # method 1
30 nrow(mydata[mydata$Cystitis_11==1,])
31 nrow(mydata[mydata$Cystitis_12==1,])
32
33 # method 2
34 attach(mydata)
35 nrow(mydata[Cystitis_11==1,])
36 nrow(mydata[Cystitis_12==1,])
37 detach(mydata)
```

```
> # method 1
> nrow(mydata[mydata$Cystitis_11==1,])
[1] 49
> nrow(mydata[mydata$Cystitis_12==1,])
[1] 49
>
> # method 2
> attach(mydata)
> nrow(mydata[Cystitis_11==1,])
[1] 49
> nrow(mydata[Cystitis_12==1,])
[1] 49
> detach(mydata)
```

```
29 # method 1
30 nrow(mydata[mydata$Cystitis_11==0,])
31 nrow(mydata[mydata$Cystitis_12==0,])
32
33 # method 2
34 attach(mydata)
35 nrow(mydata[Cystitis_11==0,])
36 nrow(mydata[Cystitis_12==0,])
37 detach(mydata)
```

```
> # method 1
> nrow(mydata[mydata$Cystitis_11==0,])
[1] 71
> nrow(mydata[mydata$Cystitis_12==0,])
[1] 71
>
> # method 2
> attach(mydata)
> nrow(mydata[Cystitis_11==0,])
[1] 71
> nrow(mydata[Cystitis_12==0,])
[1] 71
> detach(mydata)
```

Cystitis_1
排尿困難**且**排尿疼痛
49位 膀胱炎 + 71位非膀胱炎 = 120位
(確認是否與總數相符合)

	A	B	C	D	E	F	G
1	Temperature	nausea	Lumbar pain	Urine pushing	Micturition pains	Burning of urethra	Cystitis_1
2	35.5	0	1	0	0	0	FALSE
3	35.9	0	0	1	1	1	TRUE
4	35.9	0	1	0	0	0	FALSE
5	36	0	0	1	1	1	TRUE

確認是否

Cystitis_1 = “TRUE”時

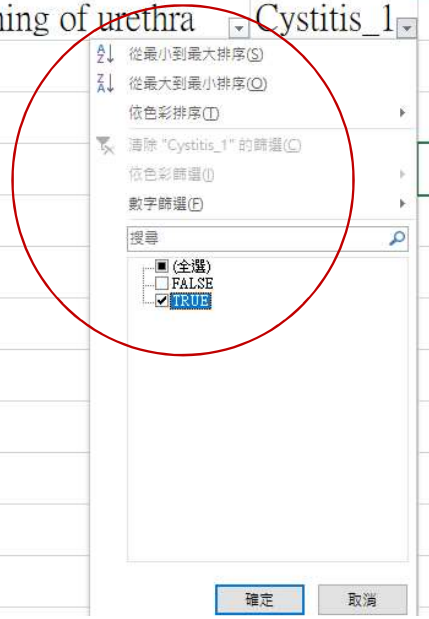
Urine pushing=1 且 Micturition pains=1

Cystitis_1 = “FALSE”時

Urine pushing=? Micturition pains=?

至少一個=0?

49 + 71 =120 check



練習

- **Cystitis_1**

排尿困難且排尿疼痛
=AND(D2=1,E2=1)

- **Cystitis_2**

排尿困難或排尿疼痛或尿道灼熱
=OR(C2=1,D2=1,E2=1)

符合排尿困難或排尿疼痛或尿道灼熱 之**膀胱炎**與**非膀胱炎**定義患者各有幾位?

```r
#-----------------------------------------------------------------------------------------------------
# Exercise
# Creating new variables Cystitis_2
# method 1
mydata$Cystitis_21 <- ifelse( ((mydata$Urine.pushing =="yes") | (mydata$Micturition.pains =="yes")|(mydata$Burning.of.urethra =="yes")), 1, 0)
head(mydata)

# method 2
attach(mydata)
mydata$Cystitis_22 <- 0
mydata$Cystitis_22[(Burning.of.urethra =="yes")|(Urine.pushing =="yes")|(Micturition.pains =="yes")] <- 1
detach(mydata)
head(mydata)


# check no. of Cystitis_2
# method 1
nrow(mydata[mydata$Cystitis_21==1,])
nrow(mydata[mydata$Cystitis_22==1,])

# method 2
attach(mydata)
nrow(mydata[Cystitis_21==1,])
nrow(mydata[Cystitis_22==1,])
detach(mydata)


# check no. of no Cystitis_2
# method 1
nrow(mydata[mydata$Cystitis_21==0,])
nrow(mydata[mydata$Cystitis_22==0,])

# method 2
attach(mydata)
nrow(mydata[Cystitis_21==0,])
nrow(mydata[Cystitis_22==0,])
detach(mydata)

```

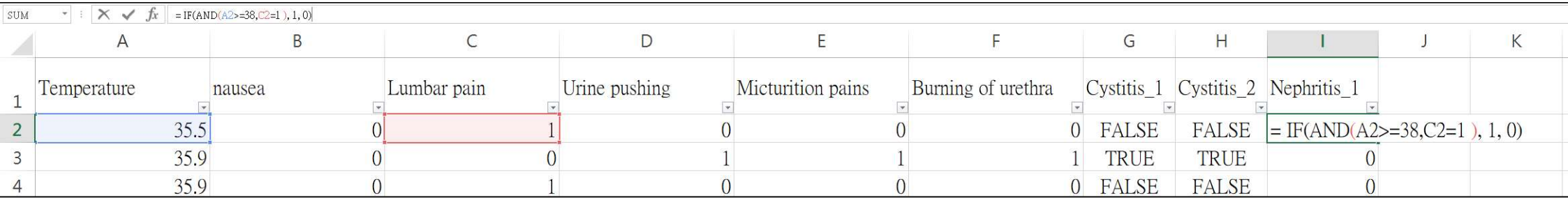
```
> head(mydata)
  Temperature nausea Lumbar.pain Urine.pushing Micturition.pains Burning.of.urethra Cystitis_11 Cystitis_12 Cystitis_21 Cystitis_22
1        35.5     no         yes            no                 no                no           0           0           0           0
2        35.9     no          no           yes                yes               yes           1           1           1           1
3        35.9     no         yes            no                 no                no           0           0           0           0
4        36.0     no          no           yes                yes               yes           1           1           1           1
5        36.0     no         yes            no                 no                no           0           0           0           0
6        36.0     no         yes            no                 no                no           0           0           0           0

> # check no. of Cystitis_2
> # method 1
> nrow(mydata[mydata$Cystitis_21==1,])
[1] 90
> nrow(mydata[mydata$Cystitis_22==1,])
[1] 90
>
> # method 2
> attach(mydata)
> nrow(mydata[Cystitis_21==1,])
[1] 90
> nrow(mydata[Cystitis_22==1,])
[1] 90
> detach(mydata)
>
>
> # check no. of no Cystitis_2
> # method 1
> nrow(mydata[mydata$Cystitis_21==0,])
[1] 30
> nrow(mydata[mydata$Cystitis_22==0,])
[1] 30
>
> # method 2
> attach(mydata)
> nrow(mydata[Cystitis_21==0,])
[1] 30
> nrow(mydata[Cystitis_22==0,])
[1] 30
> detach(mydata)
```

Nephritis_D

若 體溫 ≥ 38°C **且** 腰椎疼痛 [Lumber pain]
Nephritis_D **就** 等於 1,
否則 Nephritis_D等於 0

= IF(AND(A2>=38,C2=1), 1, 0)



SUM | = IF(AND(A2>=38,C2=1), 1, 0)

	A	B	C	D	E	F	G	H	I	J	K
1	Temperature	nausea	Lumber pain	Urine pushing	Micturition pains	Burning of urethra	Cystitis_1	Cystitis_2	Nephritis_1		
2	35.5	0	1	0	0	0	FALSE	FALSE	= IF(AND(A2>=38,C2=1), 1, 0)		
3	35.9	0	0	1	1	1	TRUE	TRUE	0		
4	35.9	0	1	0	0	0	FALSE	FALSE	0		

```r
#-----------------------------------------------------------------------------------------

# Creating new variables Nephritis_D
# method 1
mydata$Nephritis_D1 <- ifelse((mydata$Temperature >=38) & (mydata$Lumbar.pain =="yes"), 1, 0)
head(mydata)

# method 2
attach(mydata)
mydata$Nephritis_D2 <- 0
mydata$Nephritis_D2[(Temperature >=38)&(Lumbar.pain =="yes")] <- 1
detach(mydata)
head(mydata)

# check no. of Nephritis_D1 Nephritis_D2
# method 1
nrow(mydata[mydata$Nephritis_D1==1,])
nrow(mydata[mydata$Nephritis_D2==1,])

# method 2
attach(mydata)
nrow(mydata[Nephritis_D1==1,])
nrow(mydata[Nephritis_D2==1,])
detach(mydata)

# check no. of Nephritis_D1 Nephritis_D2
# method 1
nrow(mydata[mydata$Nephritis_D1==0,])
nrow(mydata[mydata$Nephritis_D2==0,])

# method 2
attach(mydata)
nrow(mydata[Nephritis_D1==0,])
nrow(mydata[Nephritis_D2==0,])
detach(mydata)
```

```
> detach(mydata)
> # Creating new variables Nephritis_D
> # method 1
> mydata$Nephritis_D1 <- ifelse((mydata$Temperature >=38) & (mydata$Lumbar.pain =="yes"), 1, 0)
> head(mydata)
  Temperature nausea Lumbar.pain Urine.pushing Micturition.pains Burning.of.urethra Cystitis_11 Cystitis_12 Cystitis_21 Cystitis_22 Nephritis_D1 Nephritis_D2
1        35.5     no         yes            no                no                 no           0           0           0           0            0            0
2        35.9     no          no           yes               yes                yes           1           1           1           1            0            0
3        35.9     no         yes            no                no                 no           0           0           0           0            0            0
4        36.0     no          no           yes               yes                yes           1           1           1           1            0            0
5        36.0     no         yes            no                no                 no           0           0           0           0            0            0
6        36.0     no         yes            no                no                 no           0           0           0           0            0            0
>
> # method 2
> attach(mydata)
> mydata$Nephritis_D2 <- 0
> mydata$Nephritis_D2[(Temperature >=38)&(Lumbar.pain =="yes")] <- 1
> detach(mydata)
> head(mydata)
  Temperature nausea Lumbar.pain Urine.pushing Micturition.pains Burning.of.urethra Cystitis_11 Cystitis_12 Cystitis_21 Cystitis_22 Nephritis_D1 Nephritis_D2
1        35.5     no         yes            no                no                 no           0           0           0           0            0            0
2        35.9     no          no           yes               yes                yes           1           1           1           1            0            0
3        35.9     no         yes            no                no                 no           0           0           0           0            0            0
4        36.0     no          no           yes               yes                yes           1           1           1           1            0            0
5        36.0     no         yes            no                no                 no           0           0           0           0            0            0
6        36.0     no         yes            no                no                 no           0           0           0           0            0            0
```

```
> # check no. of Nephritis_D1 Nephritis_D2
> # method 1
> nrow(mydata[mydata$Nephritis_D1==1,])
[1] 50
> nrow(mydata[mydata$Nephritis_D2==1,])
[1] 50
>
> # method 2
> attach(mydata)
> nrow(mydata[Nephritis_D1==1,])
[1] 50
> nrow(mydata[Nephritis_D2==1,])
[1] 50
> detach(mydata)
>
> # check no. of Nephritis_D1 Nephritis_D2
> # method 1
> nrow(mydata[mydata$Nephritis_D1==0,])
[1] 70
> nrow(mydata[mydata$Nephritis_D2==0,])
[1] 70
>
> # method 2
> attach(mydata)
> nrow(mydata[Nephritis_D1==0,])
[1] 70
> nrow(mydata[Nephritis_D2==0,])
[1] 70
> detach(mydata)
```

練習

- **Cystitis_D**

條件1:
體溫 < 38°C **且** 排尿困難 [Urine pushing]
條件2:
排尿困難 [Urine pushing] 且 排尿疼痛 [Micturition pains]

若 符合條件1 **或是** 條件2
則 Cystitis_D **就** 等於 1,
否則 Cystitis_D 等於 0

IF、OR、AND

```r
#-----------------------------------------------------------------------------------------------

# Creating new variables Cystitis_D

# method 1
mydata$Cystitis_C11 <- ifelse((mydata$Temperature < 38) & (mydata$Urine.pushing =="yes"), 1, 0)
mydata$Cystitis_C21 <- ifelse((mydata$Urine.pushing =="yes") & (mydata$Micturition.pains =="yes"), 1, 0)
mydata$Cystitis_D1 <- ifelse((mydata$Cystitis_C11==1) | (mydata$Cystitis_C21==1),1,0)

head(mydata)

# method 2
attach(mydata)
mydata$Cystitis_C12 <- 0
mydata$Cystitis_C12[(Temperature < 38)&(Urine.pushing =="yes")] <- 1
mydata$Cystitis_C22 <- 0
mydata$Cystitis_C22[(Urine.pushing =="yes")&(Micturition.pains =="yes")] <- 1
mydata$Cystitis_D2 <- 0
mydata$Cystitis_D2[(Cystitis_C12 ==1)|(Cystitis_C22 == 1)] <- 1
detach(mydata)
head(mydata)

# check no. of Cystitis_D1 Cystitis_D2
# method 1
nrow(mydata[mydata$Cystitis_D1==1,])
nrow(mydata[mydata$Cystitis_D2==1,])

# method 2
attach(mydata)
nrow(mydata[Cystitis_D1==1,])
nrow(mydata[Cystitis_D2==1,])
detach(mydata)

# check no. of Nephritis_D1 Nephritis_D2
# method 1
nrow(mydata[mydata$Cystitis_D1==0,])
nrow(mydata[mydata$Cystitis_D2==0,])

# method 2
attach(mydata)
nrow(mydata[Cystitis_D1==0,])
nrow(mydata[Cystitis_D2==0,])
detach(mydata)
```

```
> # check no. of Cystitis_D1 Cystitis_D2
> # method 1
> nrow(mydata[mydata$Cystitis_D1==1,])
[1] 59
> nrow(mydata[mydata$Cystitis_D2==1,])
[1] 59
>
> # method 2
> attach(mydata)
> nrow(mydata[Cystitis_D1==1,])
[1] 59
> nrow(mydata[Cystitis_D2==1,])
[1] 59
> detach(mydata)
>
> # check no. of Nephritis_D1 Nephritis_D2
> # method 1
> nrow(mydata[mydata$Cystitis_D1==0,])
[1] 61
> nrow(mydata[mydata$Cystitis_D2==0,])
[1] 61
>
> # method 2
> attach(mydata)
> nrow(mydata[Cystitis_D1==0,])
[1] 61
> nrow(mydata[Cystitis_D2==0,])
[1] 61
> detach(mydata)
```

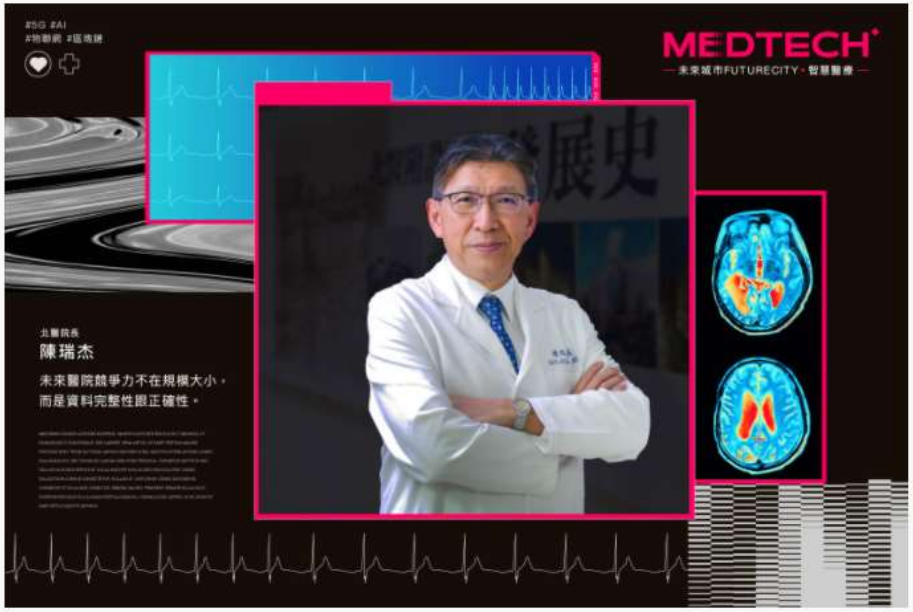
"***Knowledge*** *is the collection of skills and information a person has acquired through experience.* ***Intelligence*** *is the ability to apply knowledge*."

"*Knowledge is wonderful, but it fades as techniques and technologies come and go. Intelligence sustains. Its borders extend beyond any technique or technology, and that makes all the difference*."

Anthony Colangelo

https://alistapart.com/blog/post/knowledge-vs-intelligence/#:~:text=Knowledge%20is%20the%20collection%20of,intelligence%20to%20help%20solve%20problems.

台北醫學大學附設醫院院長陳瑞杰｜最懂區塊鏈的院長：智慧醫院只是手段，變成「好醫院」才是目的



台北醫學大學附設醫院院長陳瑞杰認為，智慧醫療的最終目的是透過智慧科技變成「好醫院」。 圖片來源：台北醫學大學附設醫院　首圖設計：yao ting

2020-10-14

Thank You
For
Your Attention!

Any Questions?

回家作業

E-mail: ijfeng@g-mail.nsysu.edu.tw

Title: [101-1 高中生物科學資優生培育計畫-高雄區_姓名_學號]

答案 [EXCEL]

程式碼 [R]

Echocardiogram Data Set 心臟超音波資料集

Donor: Steven Salzberg and Dr. Evlin Kinney

變項編號	變項英文名稱	變項中文名稱	單位		解釋
V1	age-at-heart-attack	心臟病發病年齡	year(s)	連續變項	
V2	pericardial-effusion	心包膜積水		0:無(no) 1:有(yes)	
V3	fractional-shortening	短縮分率			左心收縮力指標之一，數值越高越不正常。
V4	epss	epss			E-point septal separation。左心收縮力指標之一，數值越高越不正常。
V5	lvdd	左心室舒張末期內徑			left ventricular end-diastolic dimension。舒張末期心臟大小，數值越大越不正常。
V6	wall-motion-index	室壁運動記分指數			室壁運動異常程度，數值越高越不正常。

1. 共有 1-1 觀察值, 有 1-2 個變項。

我們欲根據心臟超音波研究結果找出有哪些心臟病發患者心臟病發後生存年份短於1年。

研究發現年齡大於65歲老年人, **若** fractional-shortening大於等於0.15 **且** EPSS大於等於10**且**LVDD大於等於4.5 **且** wall-motion-index大於1.0 **則**患者存活時間短於1年。

2. 有幾位病患 心臟病發病時年齡大於等於65 歲?
3. 有幾位病患 fractional-shortening大於等於0.15?
4. 有幾位病患 EPSS大於等於10?
5. 有幾位病患 LVDD大於等於4.5?
6. 有幾位病患 wall-motion-index大於1.0?
7. 1~5條件皆符合得有幾位?

研究另外發現年齡小於65歲者, 雖然fractional-shortening小於0.15 ，但是EPSS、LVDD與wall-motion-index 3項其中2項以上符合更為嚴苛的條件時，患者存活時間短於1年。

8. 有幾位病患 心臟病發病時年齡小於65 歲?
9. 有幾位病患 fractional-shortening小於0.15?
10. 有幾位病患 EPSS大於等於15?
11. 有幾位病患 LVDD大於等於4.5?
12. 有幾位病患 wall-motion-index大於2.0?
13. 有幾位病患符合條件9、10 、11中2項以上者?
14. 有幾位病患符合條件7 且條件8且條件12者?

15. 根據研究所發現特徵，請問共有幾位患者存活時間短於1年 (符合條件6或是條件13)？

答案

	A	B
1	姓名	
2	A1-1	
3	A1-2	
4	A2	
5	A3	
6	A4	
7	A5	
8	A6	
9	A7	
10	A8	
11	A9	
12	A10	
13	A11	
14	A12	
15	A13	
16	A14	
17	A15	

Thank You
For
Your Attention!

Any Questions?