Chapte 3.

平均數

Mean：係指平均中位數，全部 number 加埋，÷ 番 n 多個數 得出嚟既平均值

$\bar{x}$ (讀 x-bar) = Sample Mean 樣本；μ (讀 MU) = Population Mean 整体

例子：全 HK 人口年齡，就係整体 Population，係唔係到抽 1D 人做統計 research，e.g 淨抽某條街做，咁就叫 Sampling，因為冇辦法整体 All population 去問

假設 1 組數字有 n 個 number，$x_1, x_2 \ldots\ldots, x_n$ 一路排列

$\sum x_i$ = 代表呢組數字全部加埋總數：$\sum x_i = x_1+x_2+x_3 \ldots + x_n$

↘ Σ 讀 Sigma，總和 / total / 加埋嘅 / Sumation 簡寫)

If $x_1, x_2, \ldots\ldots, x_n$ 係 Sample (Statistic)，咁佢地個平均中位數就係

$$\bar{x} = \frac{\sum x_i}{n}$$

← 呢組數字入面 total 幾多個數)

If $x_1, x_2, x_3 \ldots, x_N$ 係 population (parameter)，中位數

$$\mu = \frac{\sum x_i}{N}$$

如果比組數字你，但你唔想用自己紙筆方法去搵計數機

[Stat], List 1 入晒 D 數，Then [Stat]，Mon EDIT 隔離個 CALC，撳下去，跟住第一個 1-Var Stat，[enter]，List：L1，[enter]，[enter]，出嚟第 1 個 $\bar{x}$，就係平均值中位數。

繼續 撳落去 下面 Med = Median，就真正位於中間個數，Not 平均中位數

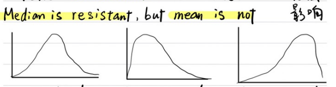
Median：係成組數最中間個數，一組數叫 "Data Set"

e.g · · · · · odd data set (odd = 奇數 / 單數) 簡中間個 or 計數機

if even data set (偶數 / 雙數)，· · · · · · · 簡最中間 2 個加埋再 ÷2

Statistic is Resistant if value 冇比太大 or 太細數 (extreme values) 影响

Median is resistant, but mean is not



mean = Median	Mean > median	Mean < Median
Symmetric 对称	Skewed to the right	Skewed to left

Exam e.g 佢問：mean = 8，median = 90

答：Skewed to left

眾數

The Mode = 出現最多。 搵边個最多出現

e.g 比組 Data 你，問，what is the Mode？

如果比個 Frequency 圖表你，叫你搵 Mean

e.g

Num	Frequen
0 - 49	10
50 - 99	5
100 - 149	13

① 先搵每 Class mid point (頭 + 尾) ÷ 2 25, 75, 125
② L1 入 Mid，L2 入 Frequency
③ CAL，1-Var，L1，L2 [Enter]，$\bar{x}$ / MED

Range 簡最大數值 一減 最細值，= Data Set Diffrence

Variance 方差

Population	Sample
$\sigma^2 = \frac{\sum (x_i - \mu)^2}{N}$	$s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1}$
σ = Sigma 細階，標準差	s = Sample 標準差
Σ = 總和，$x_i = x_1, x_2 \ldots x_N$	Σ = Sum 總和 / 加晒，$x_i = x_1, x^2, x_3 \ldots$
M = Mean 平均數	$\bar{x}$ = 平均數
N = 有 n 多個 number / 數	n = 有 n 多個數據？
$\mu = \frac{\sum x_i}{N}$	$\bar{x} = \frac{\sum x_i}{n}$

如果比堆 Data 數字你，要你搵 Variance，

① 睇係 population 定 sample，決定用边條公式

1. 先計平均數，入晒數字入 L1，用計數机計 Mean ($\mu / \bar{x}$)
2. 得出 Mean 後，L2 Hight light 成格 (L1 - 得出既平均數)^2 → $(x_i - \mu)^2$ List2
3. Sum (L2) [2nd][Mode]，[2nd][Stat]，Math，5：Sum [enter]，Sum ([2nd][2])

呢步 = 計 $\sum (x_i - \mu)^2 / \sum (x_i - \bar{x})^2$

4. 用第 3 步計出嚟個數，÷ N (有 n 多個 Data 比你)，完成！

Standard Deviation 標準差

Population	Sampling
$\sigma = \sqrt{\sigma^2}$ ← 上面條公式計	$s = \sqrt{s^2}$ s^2 上面公式計
或者直接 $\sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{N}}$	$\sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$

標準差唔使計，直接撳机出到！

1. 入晒 D 數字 Data 去 L1，
2. 去 CALA，1 - var，[enter]，会有出 s，σ！

(佢題既話 or 做題時，用呢個直出 s / σ ^2，咪得方差！)

標準差 is not resistant.

Standard deviation is affected by extreme values. (極端高/低)

Chapter 3 續上頁

如果冇比實際 1 個個數你，得個整合咗既數據表，

Frequency distribution，但要你搵 Standard deviation 標準差

Num	Frequency
0 - 49 (25)	10
50 - 99 (75)	5
100 - 149 (125)	13

mid-point $\frac{0+50}{2}$

① 咁首先要搵 mid-point
② 計平均數先 (②計出)
③ L1：Mid-point，L2 入 (L1 - mean)

L3 入 frequency，L4 入 (L2^2 x L3) 要有括落去

Population Variance 方差

$$\sigma^2 \approx \frac{\sum (\text{midpoint} - \text{mean})^2 \times \text{frequency}}{n}$$

← total n 多個 Data

Sample variance

$$s^2 \approx \frac{\sum (\text{midpoint} - \text{mean})^2 \times \text{frequency}}{n-1}$$

如果佢問 Standard deviation 既話，開方佢就得！

$\sqrt{\sigma^2}$ / $\sqrt{s^2}$，傳說中既開方差！

上面粉紅色表要計 Standard deviation，

① 搵 midpoint，搵平均數，Then 入机

1. L1 入 midpoint
2. L2 入 (L1 - 平均數
3. L3 入 frequency (表右)
4. L4 入 (L2^2 x L3) 乘前要括右側，落番落 (After ^)
5. Sum 左 L4 佢 [2nd][Mode]，[2nd][Stat]，Math 選 5 Sum，[2nd][4] L4

第⑤步等於：$\sum (\text{midpoint} - \text{mean})^2 \times \text{frequency}$

6. 用第 5 步得出個數 ÷ n or (n-1)

就会得出 variance，Then 再 √ 开方佢！

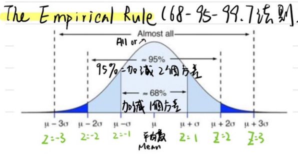
考試如果大題目要寫條公式出嚟，再列表

Midpoint	midpoint - mean	(mid-mean)² x fre
x	x	x
x	x	x
x	x	x

快捷撳机方式：(Standard deviation) 標準差

① L1 入 midpoint，L2 入 frequency
② 去 CALC，1-var，L1，L2，就出 s / σ！

The Empirical Rule (68 - 95 - 99.7 法則)



如果做題，比 1 堆數字 Date 你，叫你 use Empirical Rule Describe

① 用計數机 L1 入晒 D 數，CAL，1-var 睇 $\bar{x}$ (平均數) 同 σ_x 方差。

② 答：if we construct the histogram, this approximately "Bell - Shape" (L1 入，[2nd][y=]，[Zoom] + 9)

Thus, we can use Empirical Rule to describe the data

From T_1 - 84, we got μ = xxx, σ_x = xxx;

開始寫 μ - σ = xx - xx = ?，μ + σ = xx + xx = ?} Approximately 68% data value are between x and x

μ - 2σ ... = ?，μ + 2σ ... = ?} Appr 95% Data value between ...; μ - 3σ ... = ?，μ + 3σ ... = ?} Almost all data

Bell-Shape 用 The Empirical Rule 來估 one / two 標準差。

其他，用 Chebyshev's Inequality holds any Data Set

At least 75% / $\frac{3}{4}$ / $1 - \frac{1}{2^2}$ of Data are within 2 standard deviation 標準差

At least 89% / $\frac{8}{9}$ / $1 - \frac{1}{3^2}$ of the data within 3 個標準差

公式係 $1 - \frac{1}{k^2}$，k > 1

做題，題目比個 Mean 平均數你，+ 標準差你，No shape given

答：$\bar{x}$ = 咩，s = 咩，or μ = 咩，σ = 咩，睇題目係 Sample 定 population

For k = 2，$1 - \frac{1}{k^2} = 1 - \frac{1}{2^2} = 0.75$，we also know $\bar{x} - 2(s)$ = ? 代入數寫一次，加減 2 個標準差寫一次，Thus，at least 75% ... between n 多 and n 多

For k = 3，照上面，加減 3 個標差寫 1 次，Thus ......

$$\text{z-score} = \frac{x - \mu}{\sigma} = \frac{\text{某個數 − 平均數}}{\text{標準差}}$$

Quartiles 四分位点，將 Data 平分 4 份既 3 個点

25	25	25	25
	Q1 25%	Q2 50%	Q3 75%

，先搵中位數 Median，就会搵到其他

Q1：L = 0.25n，Q2 就係 Median，Q3：L = 0.75n

如果 L 出嚟係整數，就 [第 L 個數 + (L+1)] ÷ 2，平均數。

p.s L 係指第 L 個位果個數 e.g 12th；n 係指 total 有 n 多個數

如果 L 唔係整數，round it up to next. e.g 5.1 → 6，7.8 → 8

做題，比 1 堆數字你，e.g 有 45 個 Data

答：Since n = n 多，compute L = 0.25 n (n 多個數 total)，= n 多

Since 個答案出嚟 Not whole number, round it up to xx. Then

Q1 is the number in the xx th position, Q1 = xx

Q2 for the median is ...，Q3 又好似 Q1 咁寫多次。

其實就可以撳机撳出嚟

L1 入晒 D data，CALC，1-var，L1，就出到 Q1，Med，Q3.

之後 D Chapter 好多時直撳机，e t 就要詳細解

Chapter 1

Statistic = Collect / describ / draw conclusion from information

Population = All，全部人，又叫 Parameter

Sample = 係全部人 Population 入面抽 1 部份 ↘ Sample (Statistic)

調查分類：Equally likely

1. Simple random sample (隨机抽樣) 大合彩
   答問題如果唔貞全就寫 "Does not meet criterion" 準則
2. Sample of convenience (就手 / 方便) Criterion
3. Stratified Random Sampling (分層抽樣)
   本身已經有分开組，每個組再抽 D
4. Cluster Sampling (群)
   - Group Group A e.g household 果 D，或個 household 入面 All 人.
5. Systematic Sampling (有系統)
   e.g 每 5 個 5th 10th 15th etc
6. Voluntary Response

收集到 D 數據叫 Data Set，係 Individual 到收番嚟

收集既野叫 variable

Qualitative 分類 (Category) 性別 / 色

Quantitative 數字 e.g：Age / mileage

再分

1. Ordinal (有分次序，大中細 / 順序) e.g 一級 錦 / 偏 / 普良
2. Nominal (不能排序 e.g 血型 / 性別 / 職业)
3. Interval (Temputure
4. Ratio (Stock Closing price $$ / Dosage / 身高 / weight / time

Discrete variabe 整數 (Age

Continuous Variable 小數点 (身高 / Distance

正常來講研究結果應該一樣咖，除非 Different Treament

Randomized experiment：Small difference

Big difference = Due to different treatment

Observational Studies are less reliable 可靠

e.g 觀察研究 2 組人，吸煙 / 非吸煙者，边多心臟病多。

但有机会 1 組 男人多 D，会多啲，上年紀男人本身就心臟病多 D.

or 有人做運動，少 D 病，both 都唔关吸煙事.

呢個叫 Confouding (Confounder / Confound) 干擾因素，会令到調查結果唔一樣. e.g：age

Observational Studies 分類

Cohort Studies 隊列研究

1. cross - sectional 淨觀察 1 次
2. pro spective，之後 follow-up 去觀察
3. Retrospective，回顧番之前

case control studies 病例對照

Bias 偏見 / 偏心，分類

1. Voluntary Response bias，通常 D 人会 Strong Opinion
2. Self interest Bias，D 人会簡偏好 biased methods / treament
3. Social Acceptability Bias，D 人唔願意承認某 D 行为，reluctant to admit
4. Leading Question Bias，suggest a paticula response

Experimental Unit = Individual = 人 / animal / plant / 研究對象

又既話又可以叫 Subjeq

Outcome / Response = 研究結果 = What is measured

Treatments = 研究既種類 / 方式 / Methods / procedures.

1. Randomized Experiment = investigator assigns treatments to experiment Unit
2. Observational Study (觀察性研究)
   Treatment is not made by investigator 研究者決定
   e.g 觀察食煙 vs 唔食煙既人既分別
3. Double - Blind Experiment：neither subject / investigators know who has assigned to which treatment 佢唔知佢係咩 Group

Single blind = 病人唔知食咩藥

Still Chapter 3

Percentile 按百份比去排，計法同前面 Q1，Q3 好似

$$L = \left(\frac{P}{100}\right) n$$

，L = 第 n 位，n = total n 多個數，P = 佢比既 persentile

① 先將 D 數 Date 由細排到大

② 如果 L = 整數，{L + (L+1)} ÷ 2 = 第 n 位. e.g 58th

如果 L 唔係整數，Round it up. 5.2 → 6th，6.7 → 7th

做題，e.g 叫你計 60th percentile for the Data

答：For the 60th persentile, we compute $L = \left(\frac{P}{100}\right) n$ = 代入計

Since ?? is / is not a whole number. 同前面 Q1 Q3 咁寫。整數就計 average 比佢，唔係整數就 round up to ??th

第 ??th 位數 = n 多 n 多。答：60% of the number in the Data Set are below ......

如果調番轉，1 組 Data 比你，比個數你，搵佢既 Persentile

① 又係將 Data 由小排到大先

$$\text{Percentile} = 100 \cdot \frac{(\text{有 n 多個數細过佢比你既數}) + 0.5}{\text{\# Data Set 入面 total n 多個數}}$$ (乘)

計出嚟個數唔整既話，四捨五入

做題，如果問你 e.g 2.3 係 Data Set 到代表 n 多 persentile

1. 首先你要搵有 n 多個數細过 2.3

答：$\text{persentile} = 100 \cdot \left[\frac{(\text{n 多個數細过 2.3}) + 0.5}{\text{Total Data set n 多個數}}\right]$ (乘)，代入 D 數計

答：we round up to 四捨五入，the value 2.3 corresponds to the ... 第 n th 位 persentile

The Five - number Summary

min，Q1，Median，Q3，Max

最細既，Q1，中位，Q3，最大

撳 TI-84，入晒 L1，CALC，1-Var 就出晒嚟

Outlier 向外。e.g 一組數入面，有個數零零星星特別大 / 特別細，1 睇就出錯既

Interquartile Range (IQR) 四分位數間距

IQR = Q3 - Q1 範圍

Lower Outlier Bounder = Q1 - 1.5 (IQR) 乘

Upper Outlier Bounder = Q3 + 1.5 (IQR)

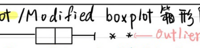
Lower Out | upper out

高 or 低过呢個点就係 outlier 界外

做題既話又係比堆數字你，Identify any Outlier.

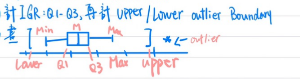
① 入晒 L1 先，CALC，1var，L1，計數机出到 Q1，Q3
② 寫 Using the TI - 84，Q1 = xx，Q3 = xx
③ IGR = Q3 - Q1 = xx - xx = xx
④ The outlier boundary：Lower：Q1 - 1.5 (IQR) = 代入 xx - 1.5 (xx) = ?
   upper outlier boundary = Q3 + 1.5 (IQR) = xxx + 1.5 (xx) = ?
⑤ 可以畫線表示 Lower upper，Then 答 Since 咩 Greater than .. So，x xx is an outlier

Boxplot / Modified boxplot 箱形圖

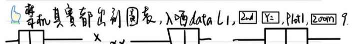


做題如果比一堆 Data 你，叫你 Identify any outiler

① 先搵 "Five number summary" 撳机 L1 入晒，CALA，1-var 执出 min，Q1，Med，Q3，Max
② 計 IGR：Q1 - Q3，再計 upper / Lower outlier Boundary
③ 畫



撳机其實都出到圖表，入晒 data L1，[2nd][Y=]，Plot1，[Zoom] 9.



Skewed to the right	Skewed to the left	Approximately Symmetric

Sample

$\bar{x}$ = 平均數

n

s：標準差

population

μ = 平均數

N

σ：標準差

$$\bar{x} \approx \frac{\sum (\text{midpoint})(\text{frequency})}{\sum \text{frequency}}$$

sum (全部 freq 加埋 1 齊)

Chapter 2

Frequency = 某樣野係某組 Data set 出現左 n 多次

frequency distribution = 表寫 D 野出現 n 次？

通常会叫你 construct (整個表)

e.g

Type	Frequency
A	n 次？
B	? 次
C	? 次

[Stat] EDIT [Enter]，L1 入返個 frequency，Then 撳 hight light L2 [Enter]，[2nd] 1 (L1) ÷ freq 加埋總和

計 relative frequency

Relative frequency = 類似%，佔 1 份入面 n 多？ proportion

要用計數机撳

$$\text{Relative Frequency} = \frac{\text{Frequency}}{\text{Sum of all frequency}}$$

(全部加埋總數)

Frequency distribution 表將數據分為不同組別 (Class)

Class	Freqrecy
0 - 4	? 次
5 - 9	? 次
10 - 14	? 次

1st Class，2nd Class，3rd Class

每 Class 相距 = 5 (Class Width)

0 = Lower class limit

4 = Upper class limit

Class midpoin = (頭 + 尾) ÷ 2

2.5，7.5，12.5 N 依然係 5

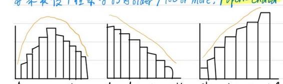
做題時 width 佢会提供，簡個最細值去決定 first Class 係咩

Too few class = Lacking in Detal

Too many class = Too much Detail

class = 每 1 組

如果最後 1 組係 e.g 85 & older / 100 or more，叫 open-ended



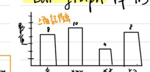
Approximaatly symmetric 对稱	skewed to the right (positively skewed)	Skewed to the left (Negatively skewed)

Unimodal 單峰 peak	Bimodal 雙峰 peak

baseline = 睇由 n 开始，有時唔係由零 0 开始既話，exaggerate 会誇大分別 exaggerates the differences 唔 start with 0 会 misleading

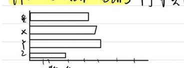
誇大 exaggerate

Bar graph 棒形圖

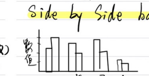


pareto chart 排高到低

Horizontal bars 打橫棒形圖

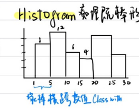


Side by Side bar Graph 孖生棒形圖



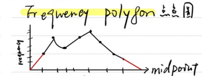
PIE Chart 圓形圖

Histogram 黐埋既棒形圖



家棒横跨數值 Class with

Frequency polygon 点点圖



mid-point = (上 Class + 下 Class) ÷ 2 (第 1 個數)

Stem - and - leaf 莖葉圖

1	0 0 1 1 2 2 2 3 ← 按大排
2	4 5 5 5 6
3	2 2 3 4 4 4
4	0 1 1 1 2 5

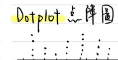
Legend 2 \| 4 = 24

雙葉

0	4	1 1 2 3
1 1	5	2 2
3 2 2	6	3 4 5 5
6 5 4 4	7	6 6 9

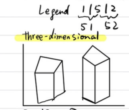
Legend 1 \| 5 \| 2 = 51 52

Dotplot 点陣圖



出現 n 多次，咪畫 n 粒点

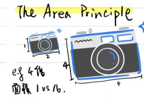
three - dimensional



3D 棒形圖

Looks shorter than they really are

The Area Principle



e.g 4 倍 面積 1 vs 16.

咁實際就變大左 16 倍而唔係 4 倍咋！Not accurate，misleading impression.

bar 準 D accurately

Chapter 5 denote = 表示 $2^{5次方}$ 搵出几多可能性：$\frac{\text{可能性次数}}{\text{底 base total 几多}}$

Probability experiment 概率
例如擲銀仔既 Probability 就係一半机会係頭 $P\frac{1}{2}$

Sample space = 所有有可能發生既結果
例：擲銀仔既 Sample space $S=\{H,T\}$ ← Head tail 頭同尾(公/字)
如果求擲頭既概率，→ P(head)，
Probability Rule 個概率一定係 0-1 中間：$0 \le P(A) \le 1$
題目問 probability 例答題係 0.x

$P(A) = \frac{\text{有A結果既次數}}{\text{全部可能性既次數}} = \frac{k}{n} = \frac{\#\text{ Outcomes in } A}{\#\text{ outcomes in Sample space}}$ ← n次，所有結果
例：0000–9999 抽到 4個位都同机率
$S=\{0000, 0001, 0002 \ldots 一路去 9999\}$ 例2，啤牌抽K概率
$P(\text{all 4 Same}) = \frac{10}{10{,}000} = 0.0001$ $\frac{4}{52} = \frac{1}{13}$，4條K

Unusual Event 机率細过 0.05 就係 Unusual

Empirical Method = 好多好多次 Large number times
不斷重複，最後結果就会同 P(x) 好接近

有時真實好難試咁多次，就用 simulations 模擬測試 (Virtual Experiment)

General additon Rule. 一般性加法規則
Two events A and B 減番中間重複左果part
$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
Rene 教：或者如果見重疊去數，寫1次就得，就唔洗減

Compound 混合 = Two or more Event

Matually Exclusive = 2個完全唔关事，互相排斥
例：轉左 vs 轉右，冇可能同時發生；啤牌 A 同 K.
Not 互斥例子，紅♡同K，因為可以紅心♡K
☆ if A and B are mutually exclusive envent 兩個冇可能同時發生
$P(A \text{ and } B) = 0$ (A与B同時發生概率係零！
与 $\cap$

但如果係 Matually Exclue，分开獨立，但同時
例如抽 Q 同 K，$\frac{1}{13} + \frac{1}{13}$ ($\frac{4}{52}$)，但如果 (and) 就係 Ø
$P(A \text{ or } B) = P(A) + P(B)$
或 $\cup$

Complement (A^c) 除左佢，以外既範圍
$P(A^c) = 1 - P(A)$ S: □ A: ○ A^c =
A^c = 淨低既 $P(A) + P(A^c) = 1$，加埋就1份
例：40%車係細車，問大車 $P(\text{Not small car}) = 1 - P(\text{Small car}) = 1 - 0.4 = 0.6$

e.g 70%人中意朱古力，35%中意朱古力同士多啤梨，係中意朱古力人入面，几%又中意士多？
and $\frac{35}{70} = 50\%$ $\frac{\frac{a}{b}}{\frac{a}{b}} = \frac{a}{b} \div \frac{a}{b} = \frac{a}{b} \times \frac{b}{a}$ $= a \times a = a^2$

Conditional probability，A先再B (B|A)，
$P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$ B係 (A已經發生左既條件下)，發生既概率
通常題目会話 Given that ……，Given 就 A，Given = 係A既入面有几多B
(A and B) = 又係A入面，又係B揀到.

The General Multiplication Rule 一般性乘法
$P(A \text{ and } B) = P(A) \cdot P(B|A)$ 第2次，base 会变 e.g 已抽走張牌
$P(B \text{ and } A) = P(B) \cdot P(A|B)$
好多時 (A and B) 已經係一整個數，唔洗計，(A|B) 都係，佢比
Job，Interview，offer a job. 要先 interview 先出 offer (J|I)

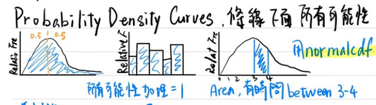
Independent，唔会影响下一次，with replacement
Dependent = 前面個數，会影响後面數，e.g 抽走牌
without replacement

Independent 2 enven A, B:
$P(A \text{ and } B) = P(A) \cdot P(B)$

"At least one" TYPE，最少有1個既全部可能性)
$1 - P(\text{Not } A)$，搵 A^c $1 - A^c$
做題時先搵全部"唔可能"既加埋. e.g 有0.3可能，咁就0.7"唔可能"
$1 - 0.7^{几多個}$

Chapter 7 搵 total 几多個結果 outcome，例擲公字，得兩個結果 H,T，即2，擲5次 total 有几多結果
寫2既5次方 $2^5 = 32$，会有32個唔同結果

Probability Density Curves，條線下面所有可能性



所有可能性加埋 = 1 Area，有時問 between 3-4 用normalcdf
藍色部 = proportion
佢1份入面0.几多? ↑ 最高位係Mean

Normal Curves
= normal distributer / normal distribution
• Mean = Median = Mode，平均數 = 中位數 = 眾數
• 因為係 Bell-Shape，所以係 Empirical Rule (68-95-99.7)
• Distribution Mean 1定係零，$\mu = 0$，$\sigma = 1$ (Standard No)
做題有時比個Z你，叫你 find the area to the left/right of z
TI 84 Lower: -1E99 E = 禁 2nd , 負 (-)
upper: z (可能係比)
μ : 0
σ : 1
禁机 2nd vars，2 normalcdf
答題時寫 Area = $P(Z \le ??\text{佢比})$ 如果問 left
$= \text{normalcdf}(-1E99, z??, 0, 1)$
(搵 porportion = 0.几)

有時比個數你，另外有比 μ, σ 你，要你搵番圖表边個位置，
用 z-score $z = \frac{x-\mu}{\sigma}$，得出z就係 等於圖表下面边個位
佢比你既數叫做 x，先搵 x 係圖表咩位置，再搵範圍
考試要畫 Graph 話比佢知. ①先搵 x 也係z位置，②畫圖表
③寫 $P(x < ??) = P(z < ①計出)$
$= \text{normalcdf}(負 -1E99, z數, 0, 1)$

左边通常係 Less / Small than，右边範圍係 longer / more than
如果叫你搵 Longer / More，同上面1樣 Step，but 右边.

如果係搵 Between，即比2個數你，叫搵中間範圍 Area
同上面差唔多，只係計2個數 z1，z2，計佢地 between
①先搵 z1，z2；②畫 Graph，
③寫 $P(低 < x < 高 ??) = P(z1 < x < z2)$
$= \text{normalcdf}(z1, z2, 0, 1)$

如果掉番轉，有比 z-score 你，叫你搵番 x，要代入
$z = \frac{x-\mu}{\sigma} \rightarrow x = \mu + z \cdot \sigma$ (平均數 + z 乘 標準差)
or 用 invNorm 都得
(冇比 x 你情況下用 invNorm)
TI 84：計答案數後有 E-4，= 0.000xxx

做題凡係比 Mean μ 同 Standard deviation 你，問你 x%
即係咩數時. or 大过 (biger/greater/heaviest) / 細过 几%，就
可以用 invNorm 2nd vars 3.
理論上 z = invNorm (Area to the lef, μ, σ)；再用z公試搵 x.
persentile ← 實際上禁机時入 %. 记住%要变 0.几；μ 同 σ 入佢比的，就得 x！
注：大过几% (Top / Greater) 就右边 right，細过就左边 left

Sampling Distribution $\bar{x}$ = 實驗結果 Random Variable
Group
每一個 $\bar{x}$ 都有自己既 probability (佔几% 0.几)，個名叫 Sampling Distribution
↑ 佔全部既几多，$\bar{x}$ 既机率係 0.几?

Sample Mean $\bar{x}$ / Population μ 凡係 $\bar{x}$ 既唔洗計
例，全班列搵大家年紀，分5個人1組，有3組，
每組既平均數 = Sample mean $\bar{x}$
3組加埋既平均數 = Population mean μ
如果搵 probability of $\bar{x}$ 大/細过咩數，用 norcdf，但要自己計 $\mu_{\bar{x}}$，$\sigma_{\bar{x}}$，下面公式
The mean of the Sampling Distribution $\mu_{\bar{x}}$
$\mu_{\bar{x}} = \mu$ ↑ 佢既平均數
其實意思：用1組人數據去搵全部3組 or 調番轉 全搵1組

Standard deviation of Sampling Distribution
$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ 搵 $\bar{x}$ 既標準差 $= \frac{\sigma \text{ 標準差}}{\text{开方 } n \sqrt{n}}$ $n = \text{几次 total 几多}$
$\sigma \neq \sigma_{\bar{x}}$

呢兩條公式 淨係可以用係中央極限，意思 n 大过 >30
Central Limit Theorem (CLT) 意思 Normal → Bell Shape
符合條件 ① n > 大过 30 或 ② 佢話你知 "Normal" population
符合其中1個條件，就係 Normal Distribution → ← CLT

比 population 既 μ σ 你
做題既話佢比堆英文你，最重要搵 n 係咪大过 30
① 寫 n = ?? > 30，we may use normal curve (CLT)
② Let's compute $\mu_{\bar{x}}$，$\sigma_{\bar{x}}$ 因为佢会提供 pop既，搵翻係
寫 $\mu_{\bar{x}} = \mu$，?? = ?? $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$，$\sigma_{\bar{x}} = \frac{代入}{\sqrt{??}}$
③ 佢通常叫你搵 what probability of 1個數 $\bar{x}$ 搵 $P(\bar{x})$ 机率
④ 畫圖 ，自己睇搵边 part，用番前面 normalcdf 搵
⑤ 有時問你個机率係咪 unusual，細过 0.05 = unusual 但入 $\mu_{\bar{x}}$ $\sigma_{\bar{x}}$

Sample proportion，$\hat{p}$，意思：呢組佔几部既几多 p-hat 總人數 n
$\hat{p} = \frac{x}{n}$ 前面搵年紀例子，代入呢到 = 搵一組人佔總人數几多
意思係1組5個人，呢5個人佔總數几多，總3組15人 (n)，$\frac{5}{15} = \hat{p} = 0.33$
Population proporton = P 擲公字机率 = P = 0.5 公 or 0.5 字

(如果1題講开 $\bar{x}$，突然問 individual (x)，當 x 咁計，
μ，σ 照入佢比，唔洗計晒)

Chapter 6

Random Variable = 實驗結果 outcome of Experiment
Discrete random variable 整數結果 e.g 几多 sibling
Continous random Variable 小數點結果 e.g. height

Probability distribution 机率分佈，個概率佔几%
佢通常係 P(x)，佢細过1：$0 \le P(x) \le 1$，全部 x 加埋等於1. $\sum P(x) = 1$
同埋唔会係負數
如果做題比 D Data 你，叫你 find the probility distribution
就搵每個數值既可能性 $P_{(x)}$，然後整個表.

x	1	2	3	4
P(x)				

計 → P(x) 通常上面会比你，你計下面，然後整表
另外有時要畫 histogram，x = 打横，底，P(x) 直/棒

Mean of a Random Variable (μ_x) 平均數.

L1 x	1	2	3
L2 P(x)	??	??	??

$\mu_x = \sum [x \cdot P(x)]$
L3 = L1 × L2，Sum L3 find total = 個 Mean (Sum = L3) 禁机
簡單版：入晒 L1, L2，1-Var, L1, L2，$\bar{x}$ = Mean 2nd Stat Math 5

Expected Value E(x) Same as Mean 唔同叫法
$E(x) = \sum [x \cdot P(x)]$ 乘

Variance (x) 方差 of a Random Variable
$\sigma_x^2 = \sum [(x - \mu_x)^2 \cdot P(x)]$ 乘
x = 佢会比，P(x) 都会比 or 要計，要搵 Mean

Standard Deviation 標準差 of a random Variable
$\sigma_x = \sqrt{\sigma_x^2} = \sqrt{\sum [(x-\mu_x)^2 \cdot P(x)]}$

x	0	1	2	3	L1
P(x)	??	??	?	?	L2

先入 L1, L2, CALC, 1-var, L1, L2 enter，就出 σ
如果係搵 variance = σ^2

☆最重要分辨到 n = 几次，P = 成功率 %变 0.几
Binomial Distribution 二項分佈
• Fixed number of trials，試既次數，用 n 表示
• Two possible outcomes，每次試驗有2個結果"成功" or "失敗"
• P(sucess) is same on each trial，每一次試驗中，既成功率一樣
• Trials are independent ·加埋机率等於1
x = 成功次數，n = 几次，P = Probabity of success
要符合晒以上條件，先叫 Binomial Distribution

nCx，if 3次入面成功2次 $_3C_2$，Math, prob, 3
Binomial Probability Distribution
$P(x) = (nCx) \cdot p^x \cdot (1-p)^{n-x}$ 乘
另外可用 binompdf / cdf 仲易D.

除左用 nCx 要搵，仲可以用 binompdf / binomcdf. → 問有8題，每題4個MC，5答對3題可能性
禁 2nd vars，拉落去 a. b. Trail = n = 几次 / 几多人 Sample size
問 more than 几多 / fewer 几多 比%, n
binompdf：$P(x = 整數)$ Exact Num P = 成功率，通常比%你，要变 0.几
binomcdf：$P(x \le ?咩數)$ x = 佢会比 20% → 0.2
(通常就咁比%，同 Size 几个) 細过等於 用 C. Complement
- 做題有時要調轉諗，e.g 大过1既可能性，就用1減細过等於1.
就用 Complement，用 1減 binomcdf 1
- 有時搵 between，例如叫你搵 between 1-4
就用 cdf ≤ 4 減 pdf 0，x=0. So 細过1，用細过等於4 - 細过等於0 就得出 between 1-4，cdf - pdf

Binomial Random Variable μ_x，σ_x^2，σ_x
設個 variable 係 x. 平均數 Mean：$\mu_x = n \cdot p$ 乘
Variance 方差 $\sigma_x^2 = n \cdot p (1-p)$ 乘乘 等於开方 $\sqrt{\sigma^2}$
Standard Deviation 標準差 $\sigma_x = \sqrt{n \cdot p (1-p)}$
如果出題講飞机 overbook，用 binomal

Chapter 7

Mean of sampling distribution of $\hat{p}$ 平均數
$\mu_{\hat{p}} = p$

Standard Deviation 標準差 of sampling distribution of $\hat{p}$
$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$
做題可能直接会比 p 同 n 你，叫你搵 $\hat{p}$ 既 Mean 同 Stan Devia

→ Central Limit Theorem (中央極限)
Normal curve (姐係 Bell-Shape) 條件：
1. $n \cdot p \ge 10$ (大过等於10)
2. $n \cdot (1-p) \ge 10$
} 要2個條件都符合先得！
如果兩個都 √ 符合既話，就 "Normal"，就係上面 $\mu_{\hat{p}} = p$ 同 $\sigma_{\hat{p}}$ 兩條公式

出題可能問你咁咁咁，係咪 normal？
咁就要搵 n = ?? p = ?? Then 代入 n.p 兩條式計睇有冇 ≥ 10，
• 如兩個符合答：are both at least 10，The distrubution of $\hat{p}$ is approximately normal by CLT (中央極限)
• 如得1符 or 冇符，答：we cannot be sure the distrubution of $\hat{p}$ is appro. normal

做題問 probability sample propotion 大过/細过几% → 0.几?化.
①先 Check assumption，搵 n.p，相乘睇係咪大过10.
②如係，寫 we may use the normal curve
③用 $\mu_{\hat{p}} = p$，$\sigma_{\hat{p}}$ 條式搵出呢2個數. 2nd Var 2
④畫 Graph，睇搵边部份，Then 用 normalcdf 計.
寫 $P(\hat{p} >/< ??問題比既%变0.几) = \text{Normalcdf}(\text{Lower}, \text{upper}, \mu_{\hat{p}}, \sigma_{\hat{p}})$
睇清 upper / Lower，因 propotion 成份係 = 1，0-1

Reject a population is approximately normal (唔係 Normal)
1. The Sample contains a outlier (有 Outlier)
2. Large degree of skewness (Skewed to the left / right)
3. Has more than one distric Mode (多过1個眾數)
其但中其中1條，就唔算係 "Normal"
多數用 plots 來睇有冇 outlier (e.g dotplot / boxplot)
如果比几個數 Data 你，畫 dot plot 睇有冇 outlier
冇就 "Normal"，有就 Reject 佢係 Normal

如果一大堆 Data 數，用 TI-84，入晒 STAT L1.
2nd Y= . 1, Enter，簡咩圖，Zoom 9 ↙ Histagram
跟住睇有冇 outlier / 有冇 skewed to left? right? 去決定

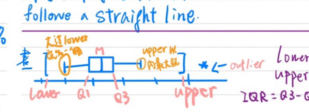
或者用 Steam - and - leaf 睇有冇多过1個眾數
冇就寫 Not multimodelity (解 more than 1 mode)

1	1123
2	2234
3	2335
4	3366
5	7899

Or 一大堆數，用点陣圖，
入番 L1 2nd Y= . 1, Enter 簡，Zoom 9

睇佢係咪成1直線，係就 Normal
followe a straight line.

畫



Lower: $Q1 - 1.5 \times (IQR)$
upper: $Q3 + 1.5 (IQR)$
$IQR = Q3 - Q1$

1堆數入晒 L1 先，Stat Calc 1-var，出 Q1, Q3, M
or，入晒 L1，2nd Y=，簡咩圖，Zoom 9. 直出.

Chapter 8

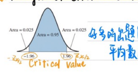
Contradict = 反对/反驳=否定

Point Estimate = Sample Mean $\bar{x}$ 個 $\bar{x}$，因為大概估出真果的數

Margin of error 誤差幅度，例寫 1個數 ± 幾，"幾" = Moe

±誤差：Margin of error = (Critical value) 乘 (Standard error)

Z_2 之點個位 $\quad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$



Critical value

好多時出題問 95% confident the popula mean is between ... and ...

平均數 M 誤差 = $\bar{x} - M < M < \bar{x} + M$

做題如比 $\bar{x}$ 同 Standard error 示你，叫你搵 90%/95% Confident popu Mean M

① 畫 Graph，搵 Critical Value Z_1, Z_2: invNorom(0.9, 0, 1) middle 用正數個個 or Z_2 = invNorm(0.95, 0, 1). Critical V = Z_2

② 寫 (M) margin of error = (Critical value)·(Standard error)

③ A 90% confindence interval for M is: $\bar{x} - m < M < \bar{x} + m$ ④計出

④ we are 90% confindent that the population mean is between xx and xx 跟住代入數字寫 1次

Critical Value = Z_2 又叫 $Z_{\alpha/2}$ Alpha

用 invNorm 搵 2nd vars 3，入佢比既％變 0.n 90% 0.9

簡 Middle，佢出 2個答案，簡正數果個 = Z_2 = $Z_{\alpha/2}$

做題可能叫 Find the critical Value $Z_{\alpha/2}$ for 92% Confident

① 畫 Graph，寫 confident level = 92 = 0.92，α_2 = 0.4

$Z_{\alpha/2}$ | $Z_{0.04}$ = invNorm(0.92, 0, 1) Middle

第1個是D. or = invNorm(1-0.04, 0, 1) left

(Normal Distrubution)

以上方法係在 population 標準差 σ 已知情況下，就可以計出 confidence interval 90/95%，但都要符合：

① 要係 simple random Sample (SRS) 即第一張揀既影響第2張

② Sample Size is large (n 大過 >30), or it tells you it's normal (如果冇寫 normal，就睇佢系咪大過30)

如比一堆數，入咗 L1 搵 $\bar{x}$ standard deviation from population 95%

做題最緊要搵 Sample Mean $\bar{x}$，同標準差 σ，跟住叫你計 90% con

① Assumtion Check: SRS ✓. Normal Distrution ✓ or n>30

② Point Estimate = $\bar{x}$ = ? 佢比

③ 搵 Critical Value (Z_2) $Z_{\alpha/2}$ = InvNorom(0.9, 0, 1) middle

④ Margin of error = m = $Z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$ = (代入)(代入) = xxxx (Sample Size)

⑤ Confidence Interval: $\bar{x} - m < M < \bar{x} + m$, Then 代入寫

⑥ We are 90% confident that the mean M is between xx and xx

驗証：用計數机驗算：Zinterval Stat 右右 test, 7, 簡 Stats, 就出 σ: xx $\bar{x}$: xx n: xx C-level: 0.9 or 0.95 (Confident 90% 95%)

如調查樣本要你搵 Sample Size (n)，N等值/N多次/N多人

$$n = \left(\frac{Z_{\alpha/2} \cdot \sigma}{m}\right)^2$$

→2次方 $Z_{\alpha/2} = Z_2$ = Critical Value，有時 S 都得

如得出小數點，round it up 整數 6.2→7

例問 How Many ... so that a 95% con interval will have 誤差 xxx (margin of error)

答：Since we want a 95% Confidence interval, we use

① $Z_{\alpha/2}$ = ... 搵 Z_2, invNrom(0.95, 0, 1) mid. 正數

畫個 Graph 比佢 2nd Var 3

② We also know that σ = 咩，m = 咩，代入

$$\Rightarrow n = \left(\frac{Z_{\alpha/2} \cdot \sigma}{m}\right)^2 = \left[\frac{①得 \cdot 佢比\sigma}{佢比m}\right]^2 = xxx.xx = 整數$$

(σ or S) round up

③ We must ...整數... in order to obain a 95% confident with a margin of error of xxx (即：要幾多先 keep 到 95% 誤差有 ...)

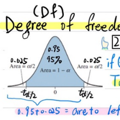
前面講既全部係 population Standeviation σ 已知/比 $Z_{\alpha/2}$

有比 σ 就用 Z，冇比就用 T. 冇比係 poplation σ，Sample 叫 S 標準差

驗算時，Stat 右右 test. Z 撳 7，T 既話撳 8

(Df) Degree of freedom = n-1，搵 $T_{\alpha/2}$ 時要用

2nd vars 4 invT. area to left, df (n-1) 9



0.95+0.025 = area to left!!

if 比 95% confident 你，同比 n 你，叫你搵 $T_{\alpha/2}$.

$T_{\alpha/2}$ = invT(1-0.025, n-1) 0.975 df

符合 $T_{\alpha/2}$ 條件：(同 $Z_{\alpha/2}$ 1樣，分別係冇比 poplution σ 嘅)

1. Simple Random Sample (SRS)
2. n > 大過 30, or 話比你知 "normal"
3. n 如少於 30，用 dot pot / boxplot 睇有冇 outlier/Skewed left/R

如都冇既，都可以當係 "Normal"

n 愈大，誤差愈細

做題 ① 如果比堆數你，叫你搵 95/98/90% confi interval mean 其實 = 計呢個名既平均數 M 誤差值係咩 (or n, $\bar{x}$, S)

① Check Assumtion (睇符合資格否) SRS ✓ n 有冇大過30，有 ✓ 如果 n 冇大過 30 就畫 dot pot，睇有冇 outlier

② 將 D 數入咗 L1, Stat, CALC, 1-var, 得出 $\bar{x}$ = ?, S = ?

寫 using TI-84, $\bar{x}$ = ?, S = ? 咩 畫圖 0.98

③ 寫 n = 咩？(佢比) df = 咩 -1. $T_{\alpha/2}$ = $t_{0.0xx}$ = invT(areaL, df) n-1

④ 計誤差 m = $t_{\alpha/2} \times \frac{S}{\sqrt{n}}$ = 代入數字寫 = 得出 m

⑤ Confidence Interval = $\bar{x} - m < M < \bar{x} + m$ 代入數字，計，寫 1次，得出 xx<M<xx

⑥ we are 98% confident that the mean number of ...... is between xxx and xxx.

計數机驗算：Tinterval Stat 右右 TEST 8

簡 "Data" 因前面入咗 L1. List: L1 fre: 1

如果冇入咗 L1，就簡 "Stats" 入 $\bar{x}$, S, n

就會出 2個數，就係誤差. C-level: 0.98/0.95/0.9 佢比你%

Chapter 8 last

Stat, CALC, 1-Var.

做題會比一堆數 Data 你，10個/8個咁

叫你 "Construct a 95% conf interval for pop Standard devi σ"

① 入咗落 L1 先，寫：Using TI-84, we find S = ??, So S^2 = ?? 自己計

② DF (Degree of freedom) = n-1 = ?, n 係佢比堆數有幾多個

③ 畫 Graph ④ 去 Table 搵 (佢比 χ² Table)

$\chi^2_{0.975}$ = ?? $\quad \chi^2_{0.025}$ = ??

($\chi^2_{1-\alpha/2}$) ($\chi^2_{\alpha/2}$)

⑤ lower bound = $\sqrt{\frac{(n-1) \cdot S^2}{\chi^2_{\alpha/2}}}$ = 代入D數寫 = 計 = 得出?? 低位

upper bound = $\sqrt{\frac{(n-1) \cdot S^2}{\chi^2_{1-\alpha/2}}}$ = 代入D數 = 得出高位!

⑥ Confidence Interval: ?? < σ < ??

⑦ we are 95% confident that the poplation standard deviation of ...... is between ... and ...

有時佢會換個方式問，"is it likely to believe that ... is 咁就要睇咗 "某數" 係唔係個範圍 ← greater/Smaller than 某數?" within / without

總結：

- 搵 Population mean M，有比 σ，用 Z-distribution 符合 "Normal" 條件先；冇比 σ，用 t-distribution (平均數)
- 搵 Population proportion (佢幾多 0.n?)，用 Z-distribution
- 搵 Population Standard deviation σ or Variance σ²，用搵 χ²-distribution (Chi-square)

invorom 計都得 用0,1	Significance Level α			
H_1	0.10	0.05	0.02	0.01
Left-tailed	−1.282	−1.645	−2.054	−2.326
Right-tailed	1.282	1.645	2.054	2.326
Two-tailed	±1.645	±1.96	±2.326	±2.576

Chp. 9

⑤ Since the P-value </> α 0.05, we (do not) Rejet Ho

⑥ There is (not) enough eridence to conclude that the proportion of .... is greter than 0.nn (問題 66)

驗算：1-ProZTest Stat 右右 Test 5

入 Po, x, n, 簡 ≠, <, >, 簡 Draw.

就出到 Z 同 P-value

Chapter 9

proportion 用 Z 計！ pp̂ $\quad$ Z: M = 0 σ = 1 $\quad$ 0-1

Hypothesis test for proportion ← 1份入面佔 n多 0.n

P = Population proportion 即係整体/全体的概率

x = 果組人入面，有n多個話咩咩.

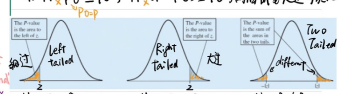
n = Sample Size 抽果組來調查，果組 (Sample) 入面 n多人

p̂ = Sample proportion 果組人既概率

$\hat{p} = \frac{x}{n} \quad x = \hat{p} \cdot n$ x 要 round up 整數

要符合晒4個條件，先係 "Normal"，先可以 hypothesis test

1. Simple Random Sample (SRS) survey = Sample, SRS (n ≤ 0.05N)
2. The proportion is at least 20 time than the Sample 整体 population 人數要大過 Sample 人數 20 倍. 有時佢話 College, nationwide，自動知 poplation 超大 多人
3. Two catagories (Population 既選項得 2個 option)
4. $n \cdot P_0 \geq 10$, $n \cdot (1-P_0) \geq 10$，兩個都要大過等於10 (P_0 = P)



$H_1: P < P_0$ 選字: Less than, shorter

$H_1: P > P_0$ Greater/taller more than

$H_1: P \neq P_0$ different / May changed

先搵 Z 位置先計到 Area: $Z = \frac{\hat{p} - P}{\sqrt{\frac{P_0 \cdot (1-P_0)}{n}}}$

做題比 P, p̂, n, α = 0.05 你 (比 x 同 n，做 proportion)，問 "Can you conclude that the proportion of ... >/</≠ xx% or 0.nn? %就變 0.n

① Assumption: ① SRS ✓ ② Population > 20 times the sample n = ? ✓

③ 2 catagories → 選擇1: $n \cdot P_0$ = 咩 ≥ 10 P_0 = P ✓ → 選擇2 = $n \cdot (1-P_0)$ = 咩 ≥ 10

② $H_0: P$ = ?? 0.n H_0: 推番假設 H_1: 假設成立

$H_1: P >/</\neq$?? $\quad$ α = 0.05/0.01

③ Test statistic: $Z = \frac{\hat{p} - P_0}{\sqrt{\frac{P_0 \cdot (1-P_0)}{n}}}$

④ P-value (搵 Area) 畫：左尾 P-value = normalcdf(−1E99, Z, 0, 1) if 右尾 (Z, 1E99, 0, 1) if 2邊尾 = 2·normlcdf (左/右視乎 Z 正/負) Z ③計出 假定推翻

Chapter 8

佢 1份 0.n多既誤差

?? > P > ??

Confidence interval for the proportion

P = population proportion 擲公字 p = 0.5公/0.5字

x = 果組入面既人數 班揀年紀，5人1組

n = 整体既人，Sample Size 共3組，即 15人 n

$\hat{p} = \frac{x}{n}$，果組人佔整体人 n多，0.n.

Point Estimate = $\hat{p} = \frac{x}{n}$

Standard error of $\hat{p}$ = $\sqrt{\frac{\hat{p} \cdot (1-\hat{p})}{n}}$

Margin of error = $Z_{\alpha/2}$ 乘 $\sqrt{\frac{\hat{p} \cdot (1-\hat{p})}{n}}$ (invNorm)

Confidence interval: $\hat{p} - m < p < \hat{p} + m$

符合以下條件先叫 "Normal"，先可以用上面公式

1. SRS
2. Population 要大過 Sample 20倍 (n 少於 5% of population)
3. items in Population are 2組 two catagories
4. 每組最少要 10個人，Sample must contain at least 10.

佢比 x, n 你時

如叫你 "Construct a 90/95/98% confident interval for proportion of......

4個 ① Assumtion Check ① SRS ✓ ② population 大過 Sample n 20倍 ✓ ③ Two catagories ④ Sample 每組別最少 10個人? ✓

都符合以上條件就係 "Normal" 就可以开始

② 搵 point estimate: $\hat{p} = \frac{x}{n}$，代入數計

③ 搵 margin of error 誤差: $m = Z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$，代入數

$Z_{\alpha/2}$ 要用 invNorm 搵 2nd Var 3. Area 入佢比既% → 0.n 簡 Center，出2個數用正數，95% 既 $Z_{\alpha/2}$ 一定係 1.96

要畫個圖比佢 0.95 名稱，數字會轉 $Z_{\alpha/2} = Z_{0.025}$

④ Confidence Internal: $\hat{p} - m < p < \hat{p} + m$，代入數寫 ③得出 m

⑤ We are 95% confident that the proportion of .... is between xxx and xxx

TI-84 Check 驗算 = 1-propZInt Stat TEST A

就出到上面 between 既2個數 x = ?, n = ?, C-level: 0.95/佢比%要 0.n

(其實就係計個 proportion 既±誤差值，果佢 0.n 的誤差)

調查樣本要搵 Sample Size $n = \hat{p} \cdot (1-\hat{p}) \cdot \left(\frac{Z_{\alpha/2}}{m}\right)^2$ ←2次方

如果出來不係整數，Round it up 6.2 → 7 $\quad$ if 95%, 1.96

有時佢表，連 p̂ 都冇比，自己計 $\hat{p} = \frac{x}{n}$ but 要 show work

比 x, n, 95%, m 誤差你，就等於叫你搵 n

做題佢問 Estimate the sample size needed

① 寫 n = ? m = ? p̂ = ? 如有比 $\hat{p} = \frac{x}{n}$

② The necessary sample size is = $n = \hat{p}(1-\hat{p})\left(\frac{Z_{\alpha/2}}{m}\right)^2$ 代入D數

計完之後就寫 "The sample size needed is ... (記得 round up)

(其實就係搵：要幾多人，先可以 95% 肯定 with xx m 誤差)

如果乜都冇比，得 95%/90% 同誤差 margin of error 比你，叫搵 n

p̂ 係咪都當佢 0.50 咁計

① Since p̂ is unknow, we use p̂ = 0.50

② $n = (0.50)(1-0.50)\left(\frac{Z_{\alpha/2}}{m}\right)^2$ ← 呢步可 Skip

$n = 0.25\left(\frac{1.96}{m}\right)^2$ ← 考試直接寫呢步 if 95%, $Z_{\alpha/2}$ 1.96

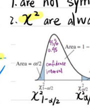
= 得出答案後 Round it up!!!

③ The sample size needed is ......

★ 當 p̂ 未知時，代入 "n =" 公式時，可直寫 $n = 0.25\left(\frac{Z_{\alpha/2}}{m}\right)^2$ (直接當佢 0.50)

Chi-square distribution → χ^2 (搵 χ^2) 唔係 bell-S 斜去右邊

1. are not symmetric. They skewed to the right
2. χ^2 are always 大過 or equal = 0 零. only 正數，唔會負數



α (Alpha) = 唔肯定既果 5%，對 95% 肯定 confidence interval

灰色 Area = α ÷ 2，因分左 2份 (左、右)

if 95% 既話，$\chi^2_{\alpha/2} = 0.025$，$\chi^2_{1-\alpha/2} = 0.975$

比 Table 你

如叫你搵 "Critical Values" for xx% confi interval, 比 degree free 你

① 畫 Graph

$\chi^2_{1-\alpha/2} = 0.975$ = ?? ← Table 搵

$\chi^2_{\alpha/2} = 0.025$ = ?? 係 Table 搵

$\chi^2_{1-\alpha/2} \to \chi^2_{0.975} \quad \chi^2_{0.025} \leftarrow \chi^2_{\alpha/2}$

到時佢會提供個表，個表永世1樣

degree of freed | Area ...... 0.975 ...... 0.025

圍兩個就係 Critical Val 答案

Chi-Square xx% cofident interval 既 χ^2 90/95/98

Population variance (方差) σ²

$$\frac{(n-1) \cdot S^2}{\chi^2_{\alpha/2}} < \sigma^2 < \frac{(n-1) \cdot S^2}{\chi^2_{1-\alpha/2}}$$

其實就係搵呢舊野既 σ/σ² (Chi table 得出)

Standard deviation 標準差 $\sigma = \sqrt{\sigma^2}$

$$\sqrt{\frac{(n-1) \cdot S^2}{\chi^2_{\alpha/2}}} < \sigma < \sqrt{\frac{(n-1) \cdot S^2}{\chi^2_{1-\alpha/2}}}$$

(n-1) = degree of freedom $\quad S^2$ = Sample Variance

再因應 ① 果個數，同 df (n-1)，去 Table 打橫打直搵番個數出來 ② ← 呢舊野係個數，if 95% → 0.025, 0.975，90% → 0.05, 0.95，98% → 0.01, 0.99 果個就係 $\chi_{\alpha/2}$，Table 得出 TI-84，數 E-5 = 小數點向左走 5個位

Chapter 11 同 Ch.7 非常似

Hypothesis Test, Two Mean, 驗 Difference, (Independent Sample)

M1, M2 = Population mean 唔識理，長期寫 $H_0: M_1 = M_2$

$\bar{x}_1, \bar{x}_2$ = Sample Mean 通常題目比兩個組別數據你比較

S_1, S_2 = Sample Standard deviation，每個組別既標準差

n_1, n_2 = Sample Size，每組別人數 n多

$H_0: M_1 = M_2$ ← 長期咁寫

$H_1: M_1 < M_2$ or $M_1 > M_2$ or $M_1 \neq M_2$

畫圖: Left tail $\quad$ Right tail $\quad$ Two tail

Standard error of $\bar{x}_1 - \bar{x}_2 = \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$ ← 2次方

Test statistic: $t = \frac{(\bar{x}_1 - \bar{x}_2) - (M_1 - M_2)}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$ ($M_1 - M_2$ = 0)

$M_1 - M_2$ = 可寫 0 or 直接唔寫，寫 $(\bar{x}_1 - \bar{x}_2)$

Degree of freedom，睇 n1, n2 邊個細，用細，n-1 (細果個)

Assumtion: ① SRS (Simple Random Sample) (符合條件) ② Independent ③ n > 30 大過30, or 話你知 Normal (每組)

做題通常比 2大組別你，各自有 Mean，標準差同 n

問 "Can you conclude that 邊組大過邊組/兩組 differ..." (α 如冇比，當佢 0.05)

① Assumtion are statisfied. SRS ✓ n > 30 ✓

② 寫低 1 = 邊組，$\bar{x}_1$ = ?咩 2 = 邊組，$\bar{x}_2$ = 咩 佢比 S_1 = 咩 S_2 = 咩 n_1 = 咩 n_2 = 咩

③ $H_0 = M_1 = M_2$

$H_1 = M_1 >/</\neq M_2$ (睇关键字!) 代入可寫 -0

④ Test satistic: $t = \frac{(\bar{x}_1 - \bar{x}_2) - (M_1 - M_2)}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$ = 代入數 = 咩? 2次方!

DF = Smaller of $n_1 - 1/n_2 - 1$

⑤ P-value: 2nd Var 6 右尾

P-Value = 2 × tcd(t, 1E99, DF) 兩邊尾 左尾 (−1E99, t, DF)

t = ④得 ≠ → t ④得

⑥ Since P-value >/< α, we (do not) reject Ho

⑦ There is (not) enough eridence to conclude that ......

They mean ... may be the same

驗算 TI 84 check: 2-SampTTest Stat 右右 4

if Raw Data - 堆數係 L1，撳 Data，否則 Stats，入咗 D $\bar{x}_1$, $\bar{x}_2$

就會出 t, P-value

承上題，如果係比 1堆數 (Raw Data) 你，入咗 L1/L2

① Assumtion are statisfic $\quad$ TI-84: 2-SampTTest

② $H_0 = M_1 = M_2$ $\quad$ List1: L1 List2: L2

$H_1 = M_1 >/</\neq M_2$ ← 关键字 $\quad$ fre1 = 1 freq2 = 1

③ Test statistic = 撳机出 $\quad$ pooled: No

P-value: 撳机出，但都要畫 Graph，同寫 tcdf(......)

④⑤ 總結.

如果淨比 x, n 你，= 問 proportion

P_1, P_2 = Population proportion 唔識理 $H_0: P_1 = P_2$ 長期

$\hat{p}_1, \hat{p}_2$ = 每組入面 $\frac{x}{n}$

x_1, x_2 = 每組入面 n多個人話 "咩"

n_1, n_2 = 每組 Sample size $\quad$ 暫時未識用，有用?

mean = $P_1 - P_2$ $\quad$ Standard Deviation = $\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}$

pooled proportion: $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$ 當佢係 θ

Standard error = $\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$

Test statistic = $\frac{(\hat{p}_1 - \hat{p}_2)}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$ 上面 pooled pro

做題如果比 2個組別既 x, n 你，問 "Can you Conclude the porportion ... Greater/Smaller/Differ Than B1組?"

① Assumtion are satisfied $\quad P_1$ = 咩組 n_1 = ? P_2 = 咩組別

② $H_0 = P_1 = P_2$ ← 長期咁寫 $\quad x_1$ = ? n_2 = ? P_2 = ?

$H_1 = P_1 >/</\neq P_2$ $\quad \hat{p}_1$ = ? $\frac{x}{n}$ x_2 = ? $\frac{x}{n}$

③ The pooled proportion: $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$ = 代入數 = 咩?

④ Test statistic = $Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$ = 代入寫 ③得出 p̂

⑤ P-value: p-value = normalcdf(−1E99, Z, 0, 1) ≠ 2邊尾要 2乘 nor，右尾 > (Z, 1E99, 0, 1)

⑥ Since P-value >/< α, we (do not) reject Ho

⑦ We can (not) Conclude that the proportion ......

They might be the same

TI 84 Check: 2-PropZTest Stat 右右 6

P Assum: 1. Two independent SRS 2. Each popla 20倍大過 Sample 3. Each Sample ⇆ Two Categorie 4. Each category 最小 10個人 individual

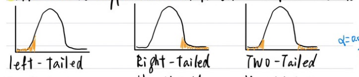
入 x1 = x2 = n1 = n2 =

就出到 Z 同 P-value

假設

Null hypotheses (Ho) M "真" or "系" or "Truth"

Althernate hypothesis (H_1) "錯" or "唔系" or "大過" or "細"



left-tailed $H_1: M < M_0$ 選字: Less/smaller

Right-tailed $H_1: M > M_0$ Greater/Higher

Two-Tailed $H_1: M \neq M_0$ diffrent/May changed

Hypothesis Test, Assume 假設 Null (Ho) 系真

1. "Reject" Null = Null 錯，H1 先岩

答題寫：We conclud that the alternate hypothesis, H_1, is true

2. "Fail to Reject" Null = Null 岩，H1 錯，接受 null 岩

答題寫：There is not enough evidence to conclude that the Alternate hypothesis, H_1, is true $\quad H_1$ false

(The null hypothesis might be true)

做錯決定時：

Type I error = 明明 Null (Ho) 係岩，但唔小心當左佢錯，唔小心 Reject 左

Type II error = Null (Ho) 是錯的，但唔小心當左佢岩 唔小心 "Not to reject" 左

P-Value Method (Hypothesis test 假設 test)

"P-Value" 係指 Graph 灰色果 part 既 Area，用 normalcdf in order 要計到 normalcdf，要搵到 Z-score 先，係條線喺邊度.

$Z = \frac{\bar{x} - M_0}{\sigma/\sqrt{n}}$ → M_0 = M，得出 Z 位置後，睇下條題 Graph tail 左定右，左 -1E99，右 1E99

搵 Z，佢叫 "Test Statistic" 有比 σ 用 Z，冇比 σ 用 t

P-value = 睇 how unusual，細過 0.05 5% 就叫 unusual

· P-value 愈細，就 the stronger the evidence against Ho

if P ≤ α, reject Ho,

if P ≥ α, do not reject Ho 咁係接受 at α level

Alpha α 多數 = 0.05，α 係呢到叫 Significant level

if P ≤ α，答題寫：Ho is rejected at the α level

or: The result is statistically significant at the α level

要符合其中 1個條件，先可以用 P-value，Z 咁計 (Assumption, Hypothesis test)

① SRS (題目好多時會講 take a simple random sam)

② Sample size n 大過 >30, or 佢話比你知 "Normal"

如果 size 細，又冇講 normal 你知，就用 Dotplot 睇冇 outlier，冇 Skeweness，都當佢 normal

做題佢比 M, σ, n, $\bar{x}$ 你，問 "Can we conclude that ...... >/</≠ α 0.05?"

① Assumption: SRS ✓ n = ?? > 30 ✓, The Assumption are statisfied

② Ho: M = ??，佢比，M_0 都係 = M $\quad$ 左尾 < less/ 右尾 > greater/taller

H_1: M > or < or ≠ ?? 睇清关键字 (α = 0.01) different ≠ 兩邊尾

③ Test Statistic = 搵 Z 位置，$Z = \frac{\bar{x} - M_0}{\sigma/\sqrt{n}}$ = 代入數寫計 = ??

④ P-value: (搵 area) 2nd vars 2 右尾計法 this 數畫

畫: P-value = normal cdf (Z 個數, 1E99, 0, 1) = ?? 左尾 (−1E99, Z 數, 0, 1) ?? ← ③得出 if 兩邊尾，要 2 × normacdf (左 or 右視乎 Z 正定負)

⑤ Since the P-value >/< α 0.05, we (do not) rejet Ho at the α level (P > α，P < α)

⑥ Conclution: (if P > α) There is not enough evidence to conclude that...

(if p < α): There is enough evidence to conclude that......

驗算 TI-84 check: Z-test Stat, 右右, test 1, 簡 Stats if $\bar{x}$ 有比 入 M_0 = 咩，σ = 咩，$\bar{x}$ = 咩，n = 咩，簡 ≠/</> 視乎果題 Then 撳 Calculate/Draw 都出到 Z, P

Plansible Value: 例 reject Ho: M = 某數 at α = 0.05 時 咁係某數 not a plansible value for M

例如 Chap.8 計 95% confident interval for M: xxx < M < xxx 某個數唔係 within ?? < M < ?? 呢個範圍，所以 outside

Alpha α = P(Type I error) α 既机率

β = P(Type II error)

如果 σ 冇比，就用 t 嚟搵 P-value，全部野同 Z 一樣 Almost

$t = \frac{\bar{x} - M_0}{S/\sqrt{n}}$ p-value = Tcdf(lower, upper, Degree of free) (搵 Area 灰) 2nd Var 6 $\quad$ n-1 $\quad$ Sample 標準差

做題如果比 1堆數你 10個 8個 Data，比 M, α, 一堆數，冇比 σ, S (→搵 $\bar{x}$/S)

入咗落 L1，1-Var 搵出 $\bar{x}$, S (Sample 標準差 Standar deviation)

① Assumption: 條件 SRS / n > 30 / 如果都唔中，而 Sample 細 就用 Dotplot 睇有冇 outlier if no outlier we may proceed hypothesis Test

② Ho: M = ?? ← 佢比

H_1: M >/</≠ ?? (視乎題目关键字去決定 < or > or ≠)

③ Test statistic (搵 t 位置) = $t = \frac{\bar{x} - M_0}{S/\sqrt{n}}$ = 代入D數 = ??

④ P-Value: (搵灰色 Area) 2邊尾 ×2 左 or 右視乎 t 正數定負數

P-value = 2·Tcdf(−1E99, −t, n−1)

2nd var 6 if 右尾 (t, 1E99, n−1) if 左尾 (−1E99, t, n−1)

p-v > α, do not reject; Not enough evident $\quad$ p-v < α, Reject, enough evident

⑤ Since the P-value >/< α, we (do not) reject Ho

⑥ There is (not) enough evidence to say/state/conclude

驗算: T-Test (Stat 右右 Test 2) 入 M_0 = ?, $\bar{x}$ = ? 簡 ≠/</> 視乎果題 如果有入 L1，簡 Data; 冇就 Stats S = ? n = ? Calculate/Draw 都出到

Chapter 11

Two Means: Paired Sample (dependent) Matched

多數比 格格表你，2行，睇 前後分別

D數入 L1 u1	前 xx	數	xx	差 x	平 x	前 x
入 L2 u2	後 xx	數	xxx	調 x	後 x	後 x
L3: L2-L1	分別 xx	xx	xxx	xxx	大減細數	後-前

} Diffrece

$\bar{d}$ = Sample Mean of the difference 果行 L3 既平均數

Sd = Sample Standard deviation of the diffrence

Md = Population mean difference for the Match Pair

Assumption (兩個都要!)

1. SRS of Matched Pairs
2. Sample size n > 30，如果細過 30 搵有冇 outlier or skewness，用 dotplot (睇佢係咪 normal)

Ho = Md = 0 ← 長期咁寫

H_1 = Md < 0 or Md > 0 or Md ≠ 0

睇关键字 右尾 2邊尾

Test statistic: $t = \frac{\bar{d} - M_0}{Sd/\sqrt{n}}$ → M_0 = 0 零

P-value 愈細，愈 very strong

愈大，not very strong

做題會比 1行 Difference 你 入咗 L1, 1-Var 搵 $\bar{x}$, $\bar{d}$

Difference	xx	xx	x?	xx	??	??	??

或者比 3行你 數字/Data

L1 前	x	?	x	?	xx
L2 後	x	?	x	?	??
L3 = L1-L2 分別	x	?	x	x	xx

L1-L2 or 大-細

① Since the sample size is small, we Construct a dotplot

寫: The dotplot does not reveal any outlier or strong skewness. So we may proceed.

② Ho = Md = 0

H_1 = Md >/</≠ 0

α = 0.01/0.05 ← if 冇比，當 0.05

③ mean difference: $\bar{d}$ = ?? Standard deviation: Sd = ?? } 入咗 L1，1-Var 出 Stat 右

④ test Statistic = $t = \frac{\bar{d} - M_0}{Sd/\sqrt{n}}$ = 代入數 = ??

④ 如果 3行既話，懶得，撳机 Stat 右右 Test 2 T-Test 簡 Data, List，睇下 L3 or L1 M_0: 0, Freq: 1 M: ≠0 <M_0 >M_0 就出到 t 同 P-value 睇关键字

⑤ P-value $\quad$ P-value: tcdf(t, 1E99, n−1) > ④ ≠ 要乘2. < (−1E99, t, n−1) = ?

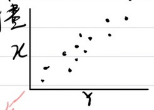
⑥ if P < α, we reject Ho. We have enough evidence ......

if p-value is nearly 0, which is very strong evidence against Ho

Chapter 4

Scatterplot 散佈圖

考試可能比2行Table你 畫點手畫



L1 X	L2 Y
xxxx	xx
xxxx	xxx
xxx	xx
xxx	xxx
xx	xxx

先入L1, L2
2nd Y= 1
on, X=L1. Y=L2
Zoom 9 出圖

向上走系 positive associated, 向下 = Negative

if 冇線連到(周圍分佈) = no linear association

Correlation Coefficient (r) 相關系數

1. 算机出r, 入晒L1, L2先. xlist = L1 Ylist = L2 Freq: 空白
2. $\boxed{\text{Stat}}$ CALC, $\boxed{4}$ 就出到r Enter

答題寫: Correlation coefficient r = xxx

if r = 正數, positive linear association
- 負數. Negative.
- 接近0, linear association weak (No linear)
- 接近1, Strongly positive; 接近-1, Negative

Least-Squares Regression Line (條斜線)

比x你, 叫搵y, (Predict 估個Y數, 因條線來估)

$\hat{y} = a \cdot x + b$ / bt $a \cdot x = b_0 + b_1$ a, b 算机出!

如果比2行表你, 叫你 "Compute the least-square Regression Line" 時 (上面格咁)

① 入晒L1, L2先, $\boxed{\text{Stat}}$ CALC $\boxed{4}$, 就出到 a, b

② The equation of the least-regression line is:

$\hat{y} = a x + b$ = ①机計出a數 × x + ①b机計出 = ??

呢條公式搵Y點位置 x係佢比你

or 問 "Predict the selling / xxx price, number" 都用咁計

(其實等於用呢條線去推斷某個位系咩數)

Y-Intercept (b) = 叫 b_0 零 = 斜線Y直在x橫既点位

•点就系 Y-Intercept (b_0) $b_0 = b$

$b_1 = a$

Slope 斜度 = 叫 b_1, = a = m = b1 = 斜度

(a) $\text{Slope} = M = \frac{y_2 - y_1}{x_2 - x_1} \Rightarrow y_2 - y_1 = m \cdot (x_2 - x_1)$

(b1) (a)

m if 正數, 向上行 ╱, if 負數, 向下行 ╲.

$\hat{y} = a \cdot x + b$

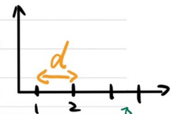
$\hat{y} = b_1 \cdot x + b_0$

$y = m \cdot x + b$ → 線開始畫 條線

↑ y

如果佢問差距n多, 差n多卡, 差距 = d

用 $b_1 \times d$ 計 (a)



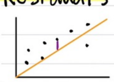
打橫叫explanatory

做題問 "2間屋如果相差x尺, 預計價錢差n錢?" (predict, differ)

① The slope of the least-square regression line is b_1 = n多. (a. 机出)

② We predict the 價錢 differ by $b_1 \cdot d$ = 代入兩個數計 = ??

Residuals = 計(實際粒点)与預計線既距离



計紫色 = $y - \hat{y}$ (預計線)

問 "What is the coefficient of determination" "How much of the variation in ......" 問名

答 ① $r^2 = (xxx)^2$ = 0.n → 變% 0.1 → 10%

② Therefore, (n%)% of variation in ....

入晒L1, L2, $\boxed{\text{Stat}}$ 右 CALC $\boxed{4}$, 直出 r^2!

$b_1 = r \frac{S_y}{S_x}$ (a) $b_0 = \bar{y} - b_1 \bar{x}$ (b)

Chapter 12

筆記為sir話考試如用binomial計 proportion 冇?

用 Chi-square Distribution (0.n) 來玩 Hypotheses Test

χ^2 ← 算机出 有條表咪搞 H_0 = xxx is the same

P-value → 都算机出 "Expected" H_1 : ..... is not the Same

睇 >, < α 0.05

例如擲色仔, 擲六十次, 每次結果多一樣, 記錄低 (叫 observed)

擲1

frequency	outcome	壹	二	三	四	五	六
	Observed	xx	xx	xx	xx	x	x

← 真擲的 高低出現n次

* 咁 Suppose 擲到每個數机率系1樣七色仔 呢個咁叫 Expeted frequency. ↑0.1667

做題: H_0 = 擲到每個數字机率一樣 (Equal)

H_1 = 机率多一樣 (differ) / Not equal

② 入L1, L2, L1入observed L2入Expected

③ using TI-84: χ^2 GOF-test $\boxed{\text{Stat}}$ TEST $\boxed{\text{D}}$

Observer = L1 df = k-1 n多結果 (擲色仔)

Expect = L2 k = Catagory 6個結果

④ Test statistic: χ^2 = ??

P-value = ??

⑤ Since P-value >/< α, we (do not) reject H_0

⑥ There is (not) enough evidence to conclude that ....

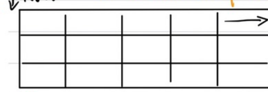
H_0 = 佢比既Conclusion系否岩既.

H_1 = 假設. 假設成立

Test for Independence and Homogneity (有n相似)

H_0: are independent H_0: ... is the same

H_1: are not indepentdent H_1: ... is not the same (differ)



Grand Total = 全部人加埋 (橫 or 直)

Expeted Frequency, $E = \frac{\text{Row total} \times \text{Colum total}}{\text{Grand Total}}$

比格格表你

做題如果叫你 Test "are independent? use α = ??" or "Test the hypothesie that .... is the Same? use α = ??"

① Assumtion ✓

② H_0 : ..... are independent / .... is the same (are equally likely) 一樣

H_1 : ..... are not independent / ...... is not the same (are not) (differ) 唔一樣

α = 0.01 / 0.05 佢比

③ $\boxed{\text{2nd}}$ $\boxed{x^{-1}}$ (Matrix) 右右 Edit $\boxed{\text{enter}}$ 改格數, 入數字 3×4

④ $\boxed{\text{Stat}}$ 右右 test $\boxed{\text{C}}$ (χ^2-test) observe [A] Expeted [B] 有時放C/D, 記改番

⑤ Test statistic: χ^2 = ??

P-value = ??

⑥ Since P-value >/< α, we (do not) reject H_0

⑦ There is (Not) enough evidence to conclude .... = Different

H_0錯, H_1岩 ← P-value < α, reject H_0, = Not independent / Not the Same

H_0岩 ✓← P-value > α, Not reject, = independent / is the Same

Ch 14.

Hypothesis: Two or more poplation Means

個個數, 佢比

種類	Sample Values μ	Sample Mean $\bar{x}$	Sample Deviation	Sample size
甲 L1	xx xx xx xx μ_1	$\bar{x}_1$	S_1	n_1
乙 L2	xx xx xx μ_2 xx	$\bar{x}_2$	S_2	n_2
丙 L3	xx xx xx μ_3 xx	$\bar{x}_3$	S_3	n_3
丁 L4	xx xx xx μ_4 xx	$\bar{x}_4$	S_4	n_4

I

入hơ 全部加晒 ÷ N = $\bar{\bar{x}}$

$\bar{\bar{x}}$: Grand Mean 總平均數

N: 全部組加埋n多個數 ($n_1 + n_2 + n_3 + n_4$) n_1 = 某組n多個數

I: 有n多組?

$SST_r = n_1 \cdot (\bar{x} - \bar{\bar{x}})^2 + n_2 \cdot (\bar{x} - \bar{\bar{x}})^2 + n_3 \cdot (\bar{x} - \bar{\bar{x}})^2 \cdots$ 去到I

$SSE = (n_1 - 1) \cdot (S_1)^2 + (n_2 - 1) \cdot (S_2)^2 + (n_3 - 1) \cdot (S_3)^2 \cdots$

$MST_r = \frac{SST_r}{I - 1}$ $MSE = \frac{SSE}{N - 1}$ $F = \frac{MST_r}{MSE}$

① Assumtion ✓

② $H_0 = \mu_1 = \mu_2 = \mu_3 = \mu_4 \ldots\ldots = \mu_I$

H_1 = Two or more of μ_i are different

α = 0.01 / 0.05 佢比

③ Test statistic = 算机 Anova $\boxed{\text{STAT}}$ 右右 Test $\boxed{\text{H}}$ 入晒L1, L2, L3, L4先 (Anova L1 $\boxed{,}$ L2, L3, L4) 直出F同P

寫 using TI-84, F = xxx 机出

P-value = xxx

④ Since P-value >/< α, we (do not) reject H_0

⑤ There is (not) enough evidence to conclude .... are the means are equal