Univ. 8 Mai 1945 2023-2024

Tutorial Series 1

Exercise 1: In a survey, people were asked how many times they visited a store before making a major purchase. The results are shown in the Table below.

Number of times in store	Frequency
1	4
2	10
3	16
4	6
5	4

1. What is the population studied and the total size of the sample?
2. Find the variable and its type.
3. Find relative frequencies and cumulative relative frequencies for the survey.
4. What is the number of people who visited the store once?
5. Find the number of people who visited the store 3 times at least.
6. Find the number of people who visited the store more than 3 times.
7. Draw the polygon and bar graph.

Exercise 2

Given the following series of data on Gender and Height for 8 patients, for each variable fill in a frequency table (for Height, use the classes 140-160,160-170,170-20)

Id	Height	Gender
1	165	M
2	157	F
3	168	F
4	178	M
5	171	F
6	182	M
7	182	M
8	153	F

1. What are the variables and their types?
2. Complete the table with the central values, the class widths..
3. Compute the mean of the Height for the eight patients. Use first the series of individual data,
4. Compute the mean starting from the frequency table.
5. Do you expect to find a difference, and why?
6. Create an appropriate graph to represent the frequency distribution.

Exercise 3: The manager of a store selling laptops recorded the number of laptops sold per day for fifty days. The data series is represented in the table below:

7	13	8	10	9	12	10	8	9	10	6	14	7
15	9	11	12	11	12	11	12	5	14	8	10	14
12	8	5	7	13	16	12	11	9	11	11	12	12
9	14	5	14	9	14	11	13	10	11	9		

1. What are the population studied the variable and its type and the modalities.
2. Find relative frequencies, cumulative relative frequencies, and the range.
3. Find the number of days the store sold 15 items.
4. Find the number of days the store sold more than 12 items.
5. Find the number of days the store sold at most 12 items.

Solution of Series 1

Ex 1: (1)

1) • The population is the people who visited a store.

• The total size of a sample is $N = \sum_{i=1}^{5} n_i$

$= 4 + 10 + 16 + 6 + 4$

$= 40$

2) We have 2 variables

• The first is Height (الطول) its type is continuous quantitative variable.

• The second is the Gender (الجنس) its type is qualitative variable.

3) We find the relative frequency (التكرار النسبي) (f_i) and cumulative relative frequencies → (التكرار المجمع النسبي)

• $f_i^c\uparrow$: relative cumulative frequency increasing (up) (+)

• $f_i^c\downarrow$: relative cumulative frequency decreasing (down) (−)

number of Times in store x_i	Frequency (n_i)	$f_i = \frac{n_i}{N}$	$f_i^c\uparrow$	$f_i^c\downarrow$
1	4	4/40 = 0,1	0.1	1
2	10	0,25	0,35	0,90
3	16	0,4	0,75	0.65
4	6	0,15	0,90	0,25
5	4	0,1	1	0,1
TOT	40	1		

4) The number of people who visited a store once
مرة واحدة

$n_1 = 4$ peoples.

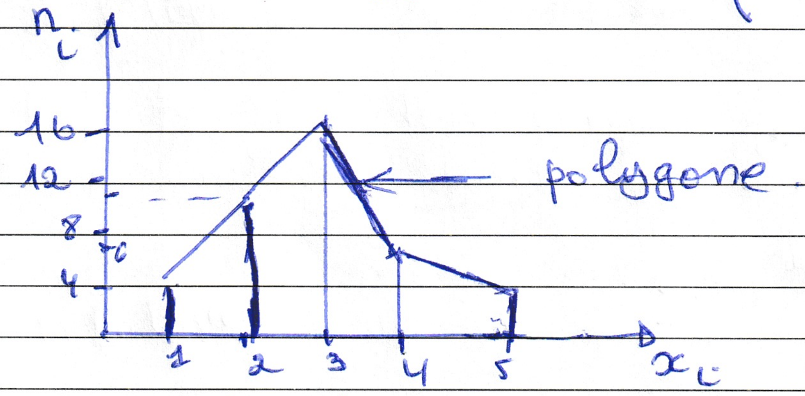
5) The number of people who visite the store 3 times at least is (3 مرات على الأقل)

$n_{x \geq 3} = n_3 + n_4 + n_5 = 16 + 6 + 4 = 26$ peoples.

6) The number of people who visited the store ~~3 times~~ ~~at least~~ more than 3 times (أكثر من) is

$n_{x > 3} = n_4 + n_5 = 6 + 4 = 10$ peoples.

7). Draw the polygone ~~and~~ and (Bar ~~cart~~ = line diagram diagramme



line diagram (مخطط الأعمدة)

Exs 2:

1) we have two (2) variables are; height an gender

- height its type is continous quantitative
- Gender is type is qualitative. (F, M)

2) Complete the table with central values m_i مراكز الفئات
$m_i = \frac{a+b}{2}$ and widths (سعة) أطوال الفئات

$W_i = b - a$

Raw data بيانات خام

i	Height	Gender
1	165	M
2	157	F
3	168	F
4	178	M
5	171	M
6	182	M
7	182	M
8	153	F

~~individual data~~

⟹

discret data

Height	n_i
153	1
157	1
165	1
168	1
171	1
178	1
182	2
TOT	8

① individual data

Continous data

Height	n_i	m_i
[140,160[	2	15[illegible]
[160,170[	2	16[illegible]
[170,200[	4	18[illegible]
TOT	8	

③ Compute the mean (المتوسط الحسابي ، $\bar{X}$) of the Height for the eight (8) patents (مرضى) using the 1st individual da[ta]

①.

$$\bar{X}_{①} = \frac{1}{N}\sum_{i=1}^{n} x_i n_i = \frac{1}{8}(153\times1 + 157\times1 + 165\times1 + 168\times \ldots + 171\times1 + 182\times2)$$

$$\boxed{X = 169{,}5}$$

4) Compute the mean starting from the frequency table (continous data).

$$\bar{X}_{②} = \frac{1}{N}\sum m_i n_i = \frac{1}{8}(150\times2 + 165\times2 + 185\times4 \ldots$$

$$\boxed{X = 171{,}25}$$

5) ~~the~~ yes we excpect (نتوقع) to find a differen[ce]

because for $X_{①}$ is ~~the~~ we use the exactly values.

but $X_{②}$ is approximate values.

EX 3 (Laptops كومبيوتر)

We order the values in increasing order

We obtain the folowing table.

x_i (nbr of items)	n_i (nbr of day's)	f_i	f_i cum ↗
5	3	0,06	0,06
6	1	0,02	0,08
7	3	0,06	0,14
8	4	0,08	0,22
9	7	0,14	0,36
10	5	0,1	0,46
11	8	0,16	0,62
12	8	0,16	0,78
13	3	0,06	0,84
14	6	0,12	0,96
15	1	0,02	0,98
16	1	0,02	1

(1) • The variable is: the days

(because we have fifty days to selling laptops)

• Modalities: 5, 6, 7, ..., 16.

(3) The ~~nb~~ number of days the store sold 15 items ~~is~~ is one (1)

(4) The number of days the store more than 12 items is (X > 12)

$n_{X>12} = 3 + 6 + 1 + 1 = 11$ items

(5) The number of days the store sold at most 12 items
على الأكثر

$(X \leq 12)$

$n_{X \leq 12} =$ ~~3~~ $3 + 1 + 3 + 4 + 7 + 5 + 8 + 8 = 39$

or $= 50 - 11 = 39$

Departemant of ST Module : Probabilty & Statistcs

Level 2nd ST LMD Year : 2024-2025

Series of exercies N° 2

Problem

Two departments (A and B) in a company recorded the monthly sales figures (in $1000s) of their employees. The sales data is grouped as follows:

Sales Range ($1000s)	Fequency department (A)	Fequency department (B)
$[10, 20[$	4	8
$[20, 30[$	12	16
$[30, 40[$	20	30
$[40, 50[$	18	22
$[50 , 60[$	6	14

Using this data, answer the following questions.

1. Find the variable and its type.
2. Plot the graph of department A and the polygone
3. Draw a less tha ogive for department (A) and more than ogive for department (B).
4. Calculate the central tendency parameters for each departmans
5. Calculate the first, the theird quartiles and interqurtil interval (IQR)
6. Calculate the variance, standard deviation and oefficient of variation of sales for both departments
7. Which department has a higher average (mean) sales?
8. What does this tell you about the most common sales range in each department?
9. Which department has a larger range, and what might this indicate about the spread of sales in each department?.
10. Considering all the measures (mean, median, mode, and range), which department appears to perform better overall in terms of sales? Justify your answer.

Departemant of TLC **Module : Probabilty & Statistcs**

Level 2nd TLC **Year : 2024-2025**

Series of exercies N° 3

Exercice 1 :

A word contains the letters A,B,C,D, and E. Answer the following questions:

1. **How many different ways can all 5 letters be arranged?**
2. **If the first letter must be A, how many arrangements are possible for the remaining letters?**
3. **How many arrangements are possible if A and B must always be next to each other?**

Exercice 2

A lot consists of 10 good articles, 4 with minor defects and 2 with major defects. Two articles are chosen from the lot at random(with out replacement). Find the probability that (i) both are good , (ii) both have major defects, (iii) at least 1 is good, (iv) at most 1 is good, (v) exactly 1 is good, (vi) neither has major defects and (vii) neither is good

Exercice 3 :

A) A coin is tossed, and a six-sided die is rolled.

- **Define event A: The coin shows heads.**
- **Define event B: The die shows a 5.**

Are events A and B independent? Explain.

B) A box contains 3 red balls, 2 blue balls, and 5 green balls. One ball is drawn at random.

1. **What is the probability that the ball is red?**
2. **If it is known that the ball drawn is not green, what is the probability that it is red?**
3. **If two balls are drawn without replacement, what is the probability that the second ball is blue, given that the first ball is red?**

Exercice 4 : **Suppose that two factories supply light bulbs to the market. Factory X's bulbs work for over 5000 hours in 99% of cases, whereas factory Y's bulbs work for over 5000 hours in 95% of cases. It is known that factory X supplies 60% of the total bulbs available.**

(a) What is the chance that a purchased bulb will work for longer than 5000 hours?

(b) Given that a lightbulb works for more than 5000 hours, what is the probability that it came from factory Y ?

Solution of series 3

EX 1

The total number of arrangements of 5 distinct letters is given by the factorial of the number of letters:

$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$ arrangements.

2. If the first letter must be A, how many arrangements are possible for the remaining letters?

If the first letter is fixed as A, the remaining 4 letters (B,C,D,E) can be arranged Sin:

$4! = 4 \times 3 \times 2 \times 1 = 24$ arrangements.

3. How many arrangements are possible if A and B must always be next to each other?

If A and B must always be next to each other, treat AB(or BA) as a single "block." This reduces the problem to arranging 4 "blocks": (AB),C,D,E

The number of ways to arrange these 4 blocks is:

$4! = 24$

Within the AB block, A and B can be arranged in: $2! = 2$

So the total number of arrangements is: $4 \times 4! \times 2! = 24 \times 2 = 192$ arrangements.

Where 4 is the number of positions of AB

<u>EX2</u>

The given lot contains:

- 10 good articles
- 4 with minor defects
- 2 with major defects
  So, the total number of articles = 10+4+2=1610 + 4 + 2 = 1610+4+2=16.

(i) Probability that both are good

The number of ways to choose 2 good articles from 16 is

$n(S) = C_{16}^{2}$=120

Let the event A :' 2 good articles are choosen'

The number of ways to choose 2 good articles from 10 is

$n(A) = C_{10}^{2}$=45

So, $p(A) = \frac{n(A)}{n(S)} = \frac{45}{120}$

(ii) **Probability that both have** major defects:

To select 2 articles with major defects:

Let the event B :' 2 articles with major defects are choosen'

$n(B) = C_{2}^{2}$=1

, $p(A) = \frac{n(B)}{n(S)} = \frac{1}{120}$

(ii) Probability that at least 1 is good: *(* it means one is good or two are good)

Let the event C :'at leat 1 is good'

So, $n(C) = C_{10}^{1} \times C_{6}^{1} + C_{10}^{2}$ (C_{6}^{1} it means one choosen from the reste 16-10)

$$p(C) = \frac{n(C)}{n(S)} = \frac{C_{10}^{1} \times C_{6}^{1} + C_{10}^{2}}{120} = \frac{10 \times 6 + 45}{120} = \frac{105}{120}$$

Or the complement is that neither is good (both are not good)

P(at least 1 good)=1−P(neither good) =1 − $\frac{C_{6}^{2}}{120}$ =1-$\frac{15}{120} = \frac{7}{8}$

(iv) Probability that at most 1 is good:

This includes the cases where 0 or 1 article is good:

Let D the event D :' at most 1 is good'

$n(D) = C_{10}^{1} \times C_{6}^{1} + C_{10}^{0} \times C_{6}^{2}$,

$$p(D) = \frac{n(D)}{n(S)} = \frac{C_{10}^{1} \times C_{6}^{1} + C_{10}^{0} \times C_{6}^{2}}{120} = \frac{10 \times 6 + 1 \times 15}{120} = \frac{75}{120}$$

(v) Probability that exactly 1 is good:

$$p(E) = \frac{n(E)}{n(S)} = \frac{C_{10}^{1} \times C_{6}^{1}}{120} = \frac{10 \times 6}{120} = \frac{60}{120} = 0.5$$

(vi) Probability that neither has major defects:

This means both articles are either good or have minor defects. There are $10 + 4 = 14$ such articles.

The number of ways to choose 2 articles from these 14 is: C_{14}^{2}

$$p(F) = \frac{n(F)}{n(S)} = \frac{C_{14}^{2}}{120} = \frac{91}{120} =$$

(vii) Probability that neither is good:

This means both articles are defective (either minor or major defects). There are 4+2=6 defective articles.

The number of ways to choose 2 defective articles is: C_{6}^{2}

$$p(G) = \frac{n(G)}{n(S)} = \frac{C_{6}^{2}}{120} = \frac{15}{120} =$$

<u>EX 3</u>

A)

Event A: The coin shows heads.

Event B: The die shows a 5.

Definition of independence: Two events, Aand B are independent iff

P(A∩B)=P(A)·P(B)

$S = \{\{1,T\},\{2,T\},\{3,T\},\{4,T\},\{5,T\}\},\{6,T\},\{1,H\},\{2,H\},\{3,H\},\{4,H\},\{5,H\},\{6,H\}$

$n(S) = 12$

$A = \{\{1,H\},\{2,H\},\{3,H\},\{4,H\},\{5,H\},\{6,H\}\},\ n(A) = 6$

$P(A)=\frac{n(A)}{n(S)}=\frac{6}{12}=\frac{1}{2}$ | $B=\{\{5,H\},\{5,T\},\}$, $n(B)=2$

$$P(B)=\frac{n(B)}{n(S)}=\frac{2}{12}=\frac{1}{6}$$

$A\cap B=\{\{5,H\}\}, n(A\cap B)=1$

$$P(A\cap B)=\frac{n(A\cap B)}{n(S)}=\frac{1}{12}=\frac{1}{2}\times\frac{1}{6}=P(A)\times P(B)$$

We dedues that A and B are independents

B)

1. The probability that the bal lis red

R : the bal lis red, $n(R)=C_3^1$, $n(S)=C_{10}^1$ =10, $\mathrm{P(R)}=\frac{\mathrm{n(R)}}{\mathrm{n(S)}}=\frac{C_3^1}{C_{10}^1}=\frac{3}{10}=0.3$

2. The probability that the probability that is red and given that the bal lis not green

$\overline{g}$: the balli is not green

$P(R\ /\overline{g}\ )=\frac{C_3^1}{C_5^1}=\frac{3}{5}$ =0.6

3. The probability that the second ball is blue and given the first ball is red

B_2 : the second ball is blue

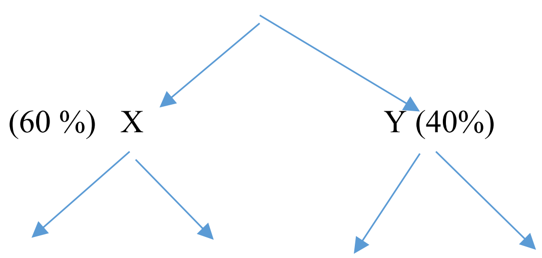
R_1 : the first bal is red

Red: 3−1=2, Blue: 2, Green: 5 , Total remaining balls = 2+2+5=9

.$P(\mathrm{B2}\ |\mathrm{R1}\ )=\frac{C_2^1}{C_9^1}=\frac{2}{9}=$

EX 4 :

The light bulbs came from



(99%) W (1%) $\overline{W}$ (95%) W $\overline{W}$ (5%)

Let the following events :

X :' the light bulbs came from factory X' ; P(X)=0.6 , P(W ǀX)=0.99

Y :' the light bulbs came from factory Y', P(Y)=0.4 P(W ǀY)=0.95

W :' the light bulbs work more than 5000h'

1) The chance (probability) that the light bubls will work longuer than 5000h

We applay the formula of total probability

P(w)= P(W ǀX) P(X)+ P(W ǀY) P(Y)=(0.99.0.6)+(0.95.0.4)=0.974

2) The probability that it came from factory Y **?**

$$P(Y / W) = \frac{P(W | Y)P(Y)}{P(w)} = \frac{0.95.0.4}{0.974} = 0.39$$