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Faculty of Exact Sciences and Natural and Life Sciences

Departement of Mathematics and Computer Science

First year Licence **Introduction to probability and descriptive statistics**

Answers of the first series : Bacis concepts and statistical vocabulary

Answer 01 :

Items X_1, X_4, and X_{12} are quantitative discrete.

Items X_3, X_9, X_{10} and X_{14} are quantitative continuous.

Items X_2, X_5, X_6, and X_7 are qualitative nominal.

Items X_8, X_11 and X_{13} are qualitative ordinal.

Quant discrete variable	Quant continuous var	Qual nominal var	Qual ordinal var
X_1 (pop : not det) X_4 (pop : not det) X_{12} (pop : classrooms)	X_3 (pop : people) X_9 (pop : families) X_{10} (pop : computers) X_{14} (pop : cars)	X_2 (pop : people) X_5 (pop : newborns) X_6 (pop : not det) X_7 (pop : workers)	X_8 (pop : not det) X_{11} (pop : teachers) X_{13} (pop : products)

"pop" means population and "not det" means not determine.

Answer 02 : The all **measurements** (observations) for the **data set** are the following :

31 32 32 32 32 32 33 33 33 33 33 33 34 34 34 34 35 35

Answer 05 :

1. the population of interest is weeks set (group of weeks) and the population size is $n = 20$.
2. The variable of interest is the number of products sold per week and its type is quantitative discrete data.
3. Complete the following frequency table :

Number of products sold x_i	15	17	19	$\sum$
Number of weeks n_i	08	07	05	$n = 20$
Relative frequency $f_i = \dfrac{n_i}{n}$	0.4	0.35	0.25	1
Percentage $p_i = f_i \times 100\ (\%)$	40	35	25	100%
Increasing Cumulative Frequency ICF $N_{x=x_i} \uparrow$	8	15	20	////
Decreasing Cumulative Frequency DCF $N_{x=x_i} \downarrow$	12	05	0	////
Increasing Cumulative Relative Frequency ICRF $F_{x=x_i} \uparrow$	0.4	0.75	1	///
Decreasing Cumulative Relative Frequency DCRF $F_{x=x_i} \downarrow$	0.6	0.25	0	///

The formula mathematic of ICF is given by :

$$N_x \uparrow = \sum_{i\,:\,x_i \leq x} n_i\ , \quad x \in \mathbb{R}$$

Particular case : if $x = x_i$, we obtain $N_{x=x_i} \uparrow$ see line 5 in the frequency table.

The formula mathematic of DCF is given by :

$$N_x \downarrow = \sum_{i\,:\,x_i > x} n_i\ , \quad x \in \mathbb{R}$$

Or

$$N_x \downarrow = n - N_x \uparrow \quad because \quad N_x \uparrow + N_x \downarrow = n$$

Particular case : if $x = x_i$, we obtain $N_{x=x_i} \downarrow$ see line 6 in the frequency table.

The formula mathematic of ICRF is given by :

$$F_x \uparrow = \sum_{i\,:\,x_i \leq x} f_i\ , \quad x \in \mathbb{R}$$

Particular case : if $x = x_i$, we obtain $F_{x=x_i} \uparrow$ see line 7.

The formula mathematic of DCRF is given by :

$$F_x \downarrow = \sum_{i\,:\,x_i > x} f_i\ , \quad x \in \mathbb{R}$$

Or

$$N_x \downarrow = n - N_x \uparrow \quad because \quad F_x \uparrow + F_x \downarrow = 1$$

Particular case : if $x = x_i$, we obtain $F_{x=x_i} \downarrow$ see line 8.

Answer 06 :

1. The population studied is a group of students,
   the population size $n = 20$,
   the variable studied is the revision time per student,
   and its type is quantitative continuous data.
2. The number of classes by using Sturge's rule is :

$$N_{classes} = 1 + 3.3 \times \log N = 5.29 \simeq 5$$

   Then the class width (amplitude) : $a = \dfrac{max - min}{N_{classes}} = \dfrac{23-4}{5} = 3.8 \simeq 4$, so we obtain the following frequency table :

Revision time (classes) $[e_{i-1}, e_i[$	$[4,\ 8[$	$[8,\ 12[$	$[12,\ 16[$	$[16,\ 20[$	$[20,\ 24[$	$\sum$
Number of students (frequency) n_i	2	4	8	5	1	$n = 20$
Increasing Cumulative Frequency (ICF) $N_{x=e_i} \uparrow$	2	6	14	19	20	/////
Relative Frequency f_i	0.1	0.2	0.4	0.25	0.05	01
Increasing Cumulative Relative Frequency (ICRF) $F_{x=e_i} \uparrow$	0.1	0.3	0.7	0.95	1	/////

3. Line 3 : $N_x \uparrow = \sum_{x_i < x} n_i$.
   Line 4 : $f_i = \dfrac{n_i}{n}$.
   Line 5 : $F_x \uparrow = \sum_{x_i < x} f_i$.