Abbas Lagrour University - Khenchela
Faculty of Economic, Commercial and Management Sciences

1st Semester of the 2023/2024 university year first year students

An exam in descriptive statistics(**section A&B**)

Solution of EX1:

- Variable type: continuous random variable
- Preparing a suitable frequency table for the data

The range

$$\mathbf{R = e_n - e_0 = 17 - 7 = 10}$$

The number of classes

$$K = 1+3.322 \log_N = 1+3.322 \log 20 = 5.32 \approx 6$$

The length of the class

$$\boldsymbol{L = \frac{R}{K} = \frac{10}{6} = 1.7}$$

X	fi	Rel fi	⬆ cf	⬇ cf	ci	Ci fi
[07-8.7 [	5	0.25	5	20	7.85	39.25
[8.7-10.4[	**6**	**0.3**	**11**	**15**	**9.55**	**57.3**
[10.4-12.1[	0	0	11	9	-	0
[12.1-13.8[	1	0.05	12	9	12.95	12.95
[13.8-15.5 [	4	0.2	16	8	14.65	58.6
[15.5-17.2 [	4	0.2	20	4	16.35	65.4
Sum	20	1	-	-	-	233.5

- All the classes have the same length.

- The graphical representation of the ascending and descending cumulative frequency tables.

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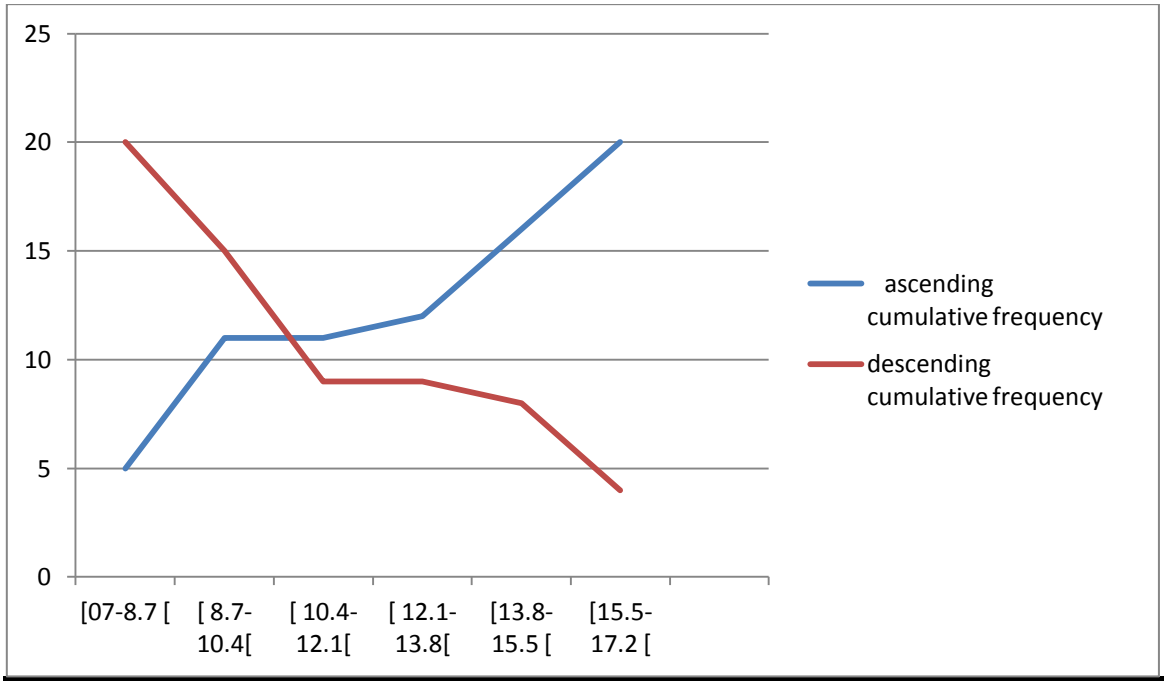

-The intersection of the ascending and descending cumulative frequency graphs is denoted by the median value of 10.825, which is visually represented by the arrow on the horizontal axis.

- The median class is [8.7-10.4 [

- Median = L + [(N/2−cf)/f] × h=10.11

Where,

- L = lower limit of the median class
- N = Total frequency
- cf = Cumulative frequency of class before the median class
- f = Frequency of the median class
- h = Class width (Upper limit - Lower limit)

- Mode :

Determine the modal class: It is the class corresponding to the highest frequency witch 6, so the modal class is: [8.7-10.4[

- Mathematical methods:

$$L + h \frac{(f_m - f_1)}{(f_m - f_1)+(f_m - f_2)} = 8.94$$

Where :

- 'L' is the lower limit of the modal class.

- 'h' is the size of the class interval.
- 'f_m' is the frequency of the modal class.
- 'f_1' is the frequency of the class that comes just before the modal class.
- 'f_2' is the frequency of the class that comes just after the modal class.

-Mean $\frac{\sum^{i=n} C_i f_i}{N}$=233.5/100=2.335

where,

- C_i = midpoint of each class
- f = frequency of the respective class
- N = total frequency

Solution of EX2:

$(ci-\bar{X})^3 f_i$	$(ci-\bar{X})^3$	$(ci-\bar{X})^2 f_i$	$(ci-\bar{X})^2$	$(ci-\bar{X})$	$c_i f_i$	ci	cf	f_i	classes
1482071904	123505992	2976048	248004	-498	10800	900	12	12	]1000-800]
423417472	26463592	1420864	88804	-298	17600	1100	28	16	]1200-1000]
18823840	941192	192080	9604	-98	26000	1300	48	20	]1400-1200]
26530200	1061208	260100	10404	102	37500	1500	73	25	]1600-1400]
468241336	27543608	1550468	91204	302	28900	1700	90	17	]1800-1600]
1265060080	126506008	2520040	252004	502	19000	1900	100	10	[2000-1800]
15069685632	-	8919600	-	-	139800	-	-	100	

$\bar{X}=\frac{\sum_{cifi}}{\sum_{fi}}=\frac{139800}{100}=1398$

1- Determining the shape of the statistical distribution of the sample using the relative measure based on moments:

- **Second central moment:**

$$m_r=\frac{1}{\sum_{i=1}^{n}}(c_i-\bar{X})^r f_i$$

$$S^2=\frac{\sum^{k}_{i=1}(ci-\bar{X})^2 fi}{N}=\frac{8919600}{100}=89196$$

$$S^2=M_2=89196$$

accordinaly: $m_2^3=(89196)^3=709636812601536$

- **Third central moment:**

$$m_3=\frac{1}{\sum_{i=1}^{n}}(c_i-\bar{X})^3 f_i$$

$$= \frac{150696856.32}{100}$$

accordinaly**:** $m_3^2 = (150696856.32)^2 = 22709542504730723.94$

$$B_1 = \frac{m_3^2}{m_2^3}$$

$$= \frac{22709542504730723.94}{709636812601536} = 320.016$$

Since $B_1>0$, the distribution curve is skewed to the right.

2- Determining the shape of the statistical distribution of the sample using Fisher coefficient of skewness:

$$S = \sqrt{S^2} = \sqrt{89196} = 298.65$$

$$S^3 = (298.65)^3 = 20424634515593.13$$

$$F_1 = \frac{m_3}{\sigma^3}$$

$$= \frac{150696856.32}{20424634515593.13}$$

Since $F_1>0$, the distribution curve is skewed to the right.

Solution of EX3:

- **The first method:**

classes	*ci*	*fi*	*ci fi*	$(ci-\bar{x})^2$	$(ci-\bar{x})^2 f_i$
10-12	**11**	**102**	1122	11.63	1186.07
12-14	**13**	**120**	1560	1.99	238.57
14-16	**15**	**200**	3000	0.35	69.62
16-18	**17**	**154**	2618	6.7	1033.05
		576	8300		2527.3

$\bar{x} = \frac{\Sigma_{cifi}}{\Sigma_{fi}} = \frac{8300}{576} = 14.41$

Calculation of the variance:

$S^2=\frac{\sum_{i=1}^{k}(xi-\bar{x})^2 fi}{N}=\frac{2527.3}{576}=4.38$

Calculation of the Standard deviation:

$S=\sqrt{S^2}=\sqrt{4.38}=2.09$

- **The second method :**

Classes	*Xi*	*fi*	*Xi* ^{2}	*Xi* ^{2} *fi*
10-12	**11**	**102**	121	12342
12-14	**13**	**120**	169	20280
14-16	**15**	**200**	225	45000
16-18	**17**	**154**	289	44506
		576		122128

$\bar{x}=\frac{\sum_{cifi}}{\sum_{fi}}=\frac{8300}{576}=14.41$

Calculation of the variance:

$S^2=\frac{1}{N}[\sum_{i=1}^{k} x_i^2 f_i]-\bar{x}^2=\frac{1}{576}[122128]-(14.41)^2=$

$\frac{1}{576}(122128)-(207.65)=4.38$

Calculation of the Standard deviation:

$S=\sqrt{S^2}=\sqrt{16.27}=4.03$