...OF SAUDI ARABIA		المملكة العربية السعودية
...ud University	جامعة الملك سعود King Saud University السنة الأولى المشتركة	جامعة الملك سعود
...anship of Common First Year		عمادة السنة الأولى المشتركة
Basic Sciences Department		قسم العلوم الأساسية

First Semester 1438/1439	Student Name: اسم الطالب:
Make up Final Exam / Stat. 101	Student ID: رقم الطالب:
Exam Time: 09:00 — 12:00	No. Section: رقم الشعبة:
Exam day: Monday 05/05/1439	Trainer Name: اسم المدرّب:

عدد صفحات الأسئلة (7) عدد الأسئلة (14)

Marking Scheme

QUESTION	SCORE	MARKS	a	b	c	d	e	f	g	h	i	j
1	2											
2	2											
3	2											
4	2											
5	8											
6	10											
7	2.5											
8	3											
9	2.5											
10	3											
11	4.5											
12	3											
13	3											
14	2.5											
Total	50											

اسم المصحّح: التوقيع

اسم المدقّق: التوقيع

أجب عن جميع الأسئلة الآتية في الفراغات المخصّصة لها حصراً

(2 marks)

Question 1: Classify each variable as Qualitative or Quantitative.	**The answer**
The variable that records the number of cities in countries.	
The variable that records heights of people.	
The variable that records ID of students.	
The variable that records age of chickens in a farm.	

(2 marks)

Question 2: Classify each variable as Continuous or Discrete.	**The answer**
The variable that records weights of children.	
The variable that records heights of people.	
The variable that records numbers of cars in cities.	
The variable that records numbers of books in libraries.	

(2 marks)

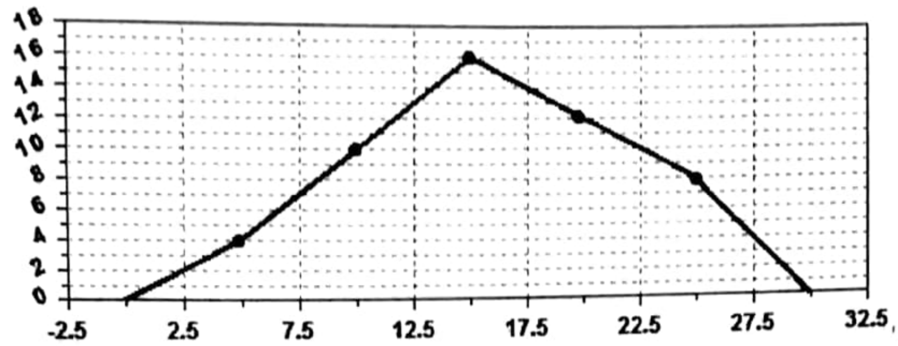
Question 3: Determine whether of the following statements is True or False.	**The answer**
$100(1-\alpha)\%$ confidence interval for the population mean μ is $\overline{x} \pm z_{1-\alpha} \frac{\sigma}{\sqrt{n}}$.	
The interquartile range is the best measure for dispersion.	
Two events A and B of 2^{Ω} are mutually exclusive if $P(A \cap B) = P(A) \cdot P(B)$.	
The statistic S^2 is an estimator for the variance σ^2 of a normal population.	

(2 marks)

Question 4: Put the right word or symbol in its proper position: $x_s - x_\ell$, $x_\ell - x_s$, $A \cap B = \varnothing$, $A \cup B = \varnothing$, $P(A \cap B) = P(A) \cdot P(B)$, $P(A \cup B) = P(A) + P(B)$, $z_0 = \frac{\overline{x} - \mu_0}{\sigma / \sqrt{n}}$, $Z = \frac{\overline{X} - \mu_0}{\sigma / \sqrt{n}}$, $z_0 = \frac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}}$, $Z = \frac{\hat{P} - p_0}{\sqrt{p_0(1-p_0)/n}}$
Two events A and B are mutual exclusive if ....
The range of raw data $x_1, x_2, \ldots, x_n$ is ....
For two events A and B, if .... Then A and B are independent.
The value of test statistic for the mean of normal population is ....

(8 marks)

Question 5: Consider data given by the following frequency polygon:



Then:

a) Complete the following frequency distribution table for the above polygon.

Class Limit	Class Boundaries	Midpoint	Frequency	Relative Frequency	Ascending Cumulative Frequency (ACF)
Sum					

b) Calculate the **mean** for the data of above frequency distribution table.

....

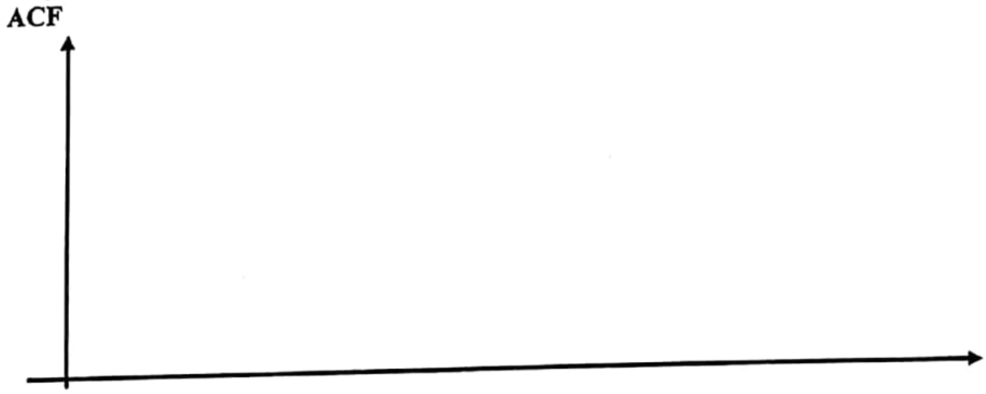
....

....

c) Calculate the **range** of data for the above frequency distribution table.

....

d) Draw the **ogive** (ascending cumulative frequency polygon) of the above frequency distribution table.



(10 marks)

Question 6: Consider the data: **7 , 9 , 8 , 6 , 2 , 7 , 15 , 7, 3 , 6 , 5 , 3 .** Then:

a) Calculate the **mean** for the given data.

b) Calculate the **median** for the given data.

c) Find the **mode** of the given data.

d) If the variance of the given data is $S^2 = 11.73$, then calculate the **standard score** for the value 5.

e) Calculate the **coefficient of variation** for the given data.

f) Calculate Q_1, Q_3, LF and HF for the given data.

For Q_1 :

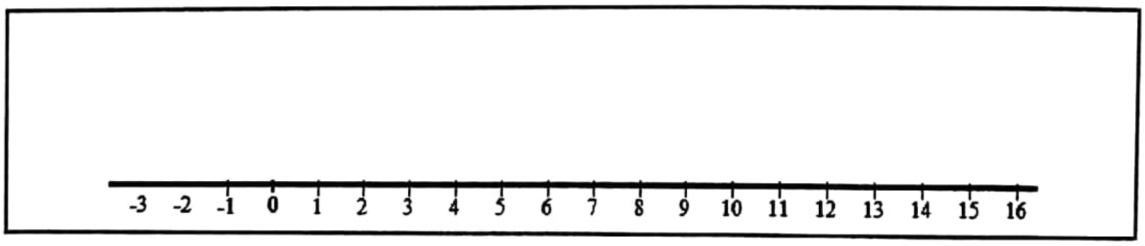
For Q_3 :

For LF :

For HF :

g) Check if the given data have **outliers**.

h) Draw the **box plot** for the given data and determine the five numbers on the graph:



(2.5 marks)

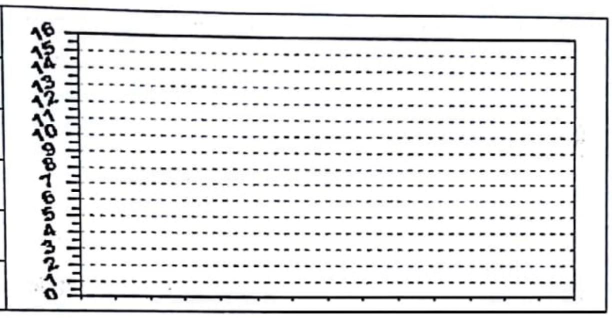
Question 7: The following data represent the grades of students:

D	B	A	D	B	A	C	A	D	C	B	B
A	C	C	B	A	A	A	C	C	A	B	C
D	B	A	B	A	D	C	B	B	C	D	B
B	A	B	A	A	A						

Then:

a) Write the frequencies of these grades and represent them graphical.

Grade	Frequency
A	
B	
C	
D	
sum	



(3 marks)

Question 8: If $[\Omega, \mathscr{A}, P]$ is a probability space of rolling a fair die one time, then:

a) Determine Ω, $\mathscr{A}$ and P for this random experiment.

$\Omega = \{1,2,3,4,5,6\}$ .... $\mathscr{A} = 2^{\Omega}$, $P: \frac{|A|}{|\Omega|}$

b) Calculate the probability of getting an even number.

$A = \{2,4,6\} \Rightarrow P(A) = \frac{|A|}{|\Omega|} = \frac{3}{6}$ ....

c) If we getting an even number, what is the probability that we have the number 2 ?

....

$1/3$ .... $\Rightarrow E = \{2,4,6\} \Rightarrow E \cap N_2 = \{2\}$ ....

....

(2.5 marks)

Question 9: If we have Ω a space of elementary evens, A and $B \in 2^{\Omega}$ with $P(A \cap B) = 0.15$, $P(A \setminus B) = 0.25$ and $P(B \setminus A) = 0.35$. Then calculate the following probabilities:

a) $P(A) =$ ....

b) $P(B) =$ ....

c) $P(A \cup B) =$ ....

d) $P(\bar{A} \cap \bar{B}) =$ ....

e) Are the events A and B independent? and why?

....

....

(3 marks)

Question 10: We select **three** balls randomly (one after another) of a box contains **5 black** and **4 green** balls. If all balls have the same chance at selecting. Now:

a) If A is the event that the selected balls are green, then calculate $P(A)$.

....

....

....

b) If B is the event that the selected balls have the same colors, then calculate $P(B)$.

....

....

....

c) What is the probability that the selected balls have different colors?

....

....

(4.5 marks)

Question 11: Suppose that $\Omega = \{1,2,3,4,5,6\}$, $\mathscr{A} = 2^{\Omega}$ and $P(A) = \frac{|A|}{|\Omega|}$. Now, let $X : \Omega \longrightarrow \mathbb{R}$ be a random variable on the probability space $[\Omega, \mathscr{A}, P]$ defined by $X(\omega) = \begin{cases} -1 & for\ \omega = 1,2 \\ 0 & for\ \omega = 3,4 \\ +1 & for\ \omega = 5,6 \end{cases}$

Then:

a) What is the name of this random variable and calculate the probability $P(X \leq 0.5)$?

....

....

b) Determine the event in the relation: $\{\omega \in \Omega \ ; X(\omega) \leq x\} = \begin{cases} \dots\dots\dots\dots & for\ x < -1 \\ \dots\dots\dots\dots & for\ -1 \leq x < 0 \\ \dots\dots\dots\dots & for\ 0 \leq x < 1 \\ \dots\dots\dots\dots & for\ x \geq 1 \end{cases}$

c) Determine the distribution function F_X and draw it.

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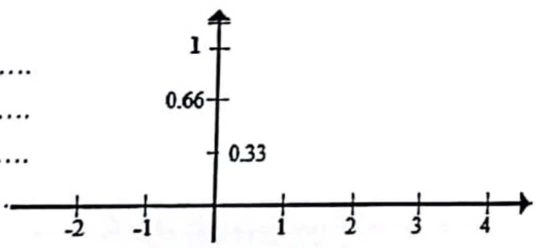
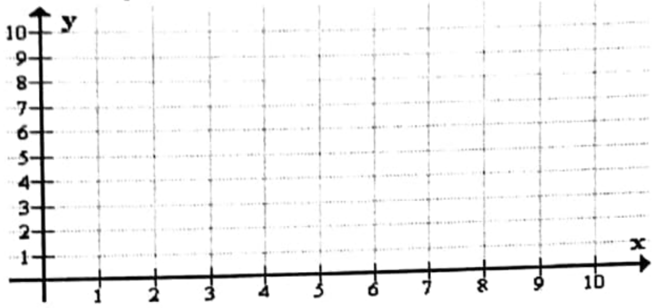


(3 marks)
Question 12: Consider the following data:

X	1	2	3	4	5	5	6	7	8	9
Y	10	9	8	7	6	5	5	4	3	2

a) Represent this data on the scatter plot.



b) If you know that $\sum_{i=1}^{10} x_i = 50$, $\sum_{i=1}^{10} y_i = 59$, $\sum_{i=1}^{10} x_i^2 = 310$, $\sum_{i=1}^{10} y_i^2 = 409$, $\sum_{i=1}^{10} x_i y_i = 235$, $\sum_{i=1}^{10} (x_i - \bar{x})^2 = 61.6$, $\sum_{i=1}^{10} (y_i - \bar{y})^2 = 65.8$ and $\sum_{i=1}^{10} (x_i - \bar{x})(y_i - \bar{y}) = -57.2$. Then calculate the coefficient of correlation (**r**).

c) Is there a linear relationship between *X* and *Y*? Is it positive or negative? Is it strong or weak?

(3 marks)
Question 13: Assume that a medical researcher collected a random sample of size 625 from Saudi adults and found 125 of them are diabetics. Then:

a) Determine 95% confidence interval for the proportion of diabetics.

b) If the point estimation $\hat{p}$ is used to estimate *p*, what is the margin error (for 95% confidence level)?

c) If the margin error δ_p = (for 95% confidence level), what is the sample size *n*?

(2.5 marks)

Question 14: Suppose we would like to breakfast if the typical amount spent per customer for breakfast at a new restaurant is more than 10 SR. A sample of 64 customers over a two-week was randomly selected and the average amount spent was 9.4 SR. Assume that the standard deviation is known to be 1.8 SR. Then using the significance level $\alpha = 0.0036$ for testing the null hypothesis $H_0 : \mu = 10$ versus the alternative hypothesis $H_1 : \mu < 10$.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

End of Exam

أجب عن جميع الأسئلة الآتية في الفراغات المخصّصة لها حصراً

(2 marks)

Question 1: Classify each variable as Qualitative or Quantitative.	The answer
The variable that records the time needed to finish a homework.	
The variable that records the lifetime of televisions.	
The variable that records the type of cars.	
The variable that records weights of students.	

(2 marks)

Question 2: Classify each variable as Continuous or Discrete.	The answer
The variable that records numbers of employees in ministries.	
The variable that records weights of sheep in a farm.	
The variable that records numbers of stories in libraries.	
The variable that records the temperature in buildings of CFY.	

(2 marks)

Question 3: Determine whether of the following statements is True or False.	The answer
We have the statistic $\overline{X}$ is an estimator for the population variance σ^2.	
The standard deviation is the best measure for dispersion.	
$100(1-\alpha)\%$ confidence interval for the proportion p is $\overline{p} \mp z_{1-\alpha} \frac{\sigma}{\sqrt{n}}$.	
If two events A and B of 2^{Ω} are mutual exclusive, then $P(A \cup B) = P(A) \cdot P(B)$.	

(2 marks)

Question 4: Put the right word or symbol in its proper position: mutual exclusive, independent, point estimation, interval estimation, $A \cap B = \varnothing$, $A \cup B = \Omega$, $z_0 = \frac{\overline{x} - \mu_0}{\sigma / \sqrt{n}}$, $Z = \frac{\overline{X} - \mu_0}{\sigma / \sqrt{n}}$, $x_\ell - x_s$, $(Q_3 - Q_1)/2$, $x_k - x_1$, $(Q_3 - Q_1)$.
If two events A and B are ………………………………., then we have $P(A \cap B) = P(A) \cdot P(B)$.
The test statistic for the mean of normal population is ………………………………...
Two events A and B are mutual exclusive if ………………………………...
For a frequency distribution table with k classes, we have the range of data is ………………………………...

(8 marks)

Question 5: Consider data given by the following frequency distribution table:

Class Limit	Class Boundaries	Midpoint	Frequency	Relative Frequency	Percentage Frequency	ACF
2 − 6			6			
	6.5 → 11.5			0.24		
		14			18 %	
	16.5 → 21.5					42
22 − 26			8			
Sum			50			

Then:

a) Complete the above frequency distribution table.

b) How many mode have the data of the above frequency distribution table? And why?

....

....

c) Calculate the **mode(s)** for the data of above frequency distribution table.

....

....

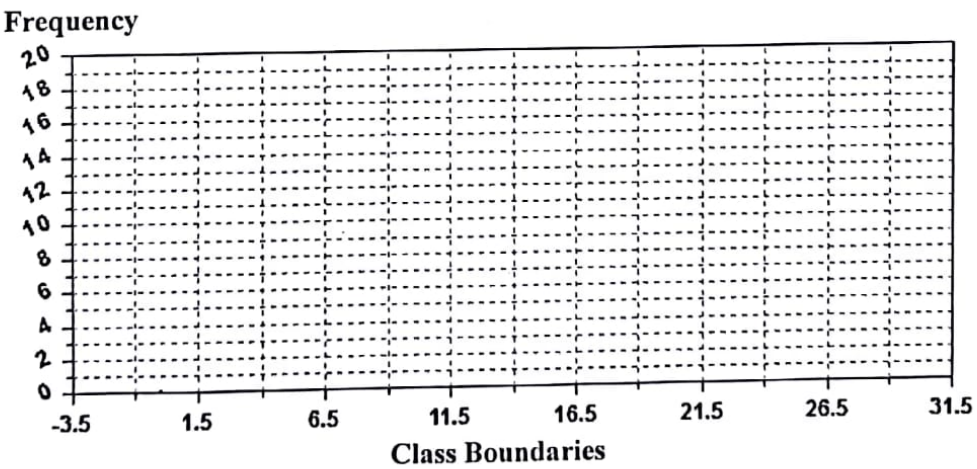
....

....

d) Calculate the **range** of data for the above frequency distribution table.

....

e) Draw the **polygon** of the above frequency distribution table.



(10 marks)

Question 6: Consider the data: **8 , 9 , 6 , 9 , 5 , 4, 7, 20, 8 , 6 , 7 , 8 .** Then:

a) Calculate the **mean** for the given data.

b) Calculate the **median** for the given data.

c) Find the **mode(s)** of the given data.

d) If the standard deviation of the given data is $S = \mathbf{4.05}$, then calculate the **standard score** for the value **9.**

e) Calculate the **coefficient of variation** for the given data.

f) Calculate P_{25}, Q_3, and HF for the given data.

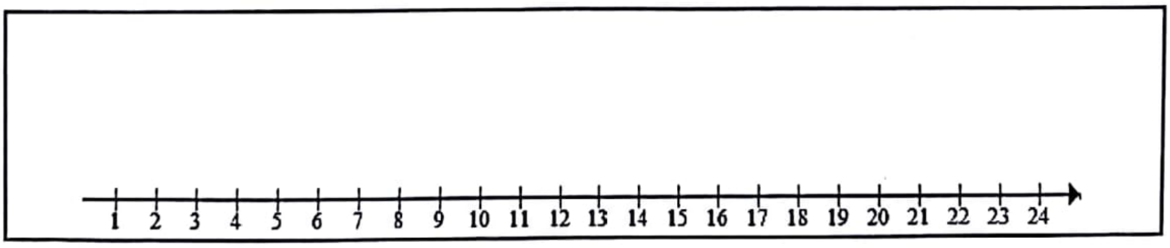
For P_{25} :

For Q_3 :

For HF :

g) Check if the given data have **extreme value(s).**

h) Draw the **box plot** for the given data and determine the five numbers on the graph:

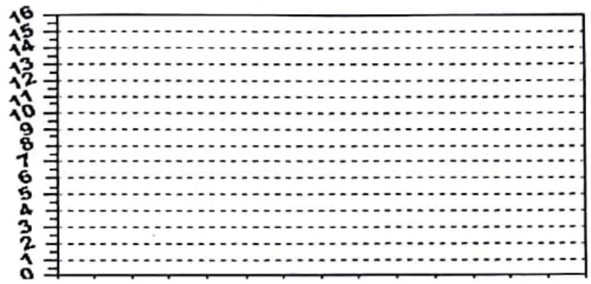


(2 marks)
Question 7: The following data represent the grades of students:

A	C	C	A	B	C	C	B	A	B	A	A
A	C	C	B	A	A	D	B	A	D	B	A
D	D	C	D	C	B	C	B	B	C	D	B
B	D	C	B	B	A	D	B	A	B	A	D

Write the frequencies of these grades and **represent** them graphical.

Grade	Frequency
A	
B	
C	
D	
sum	



(3 marks)
Question 8: If $[\Omega, \mathscr{A}, P]$ is a probability space of tossing a **fair coin** two times, then:

a) Determine Ω, $\mathscr{A}$ and P for this random experiment.

....

b) Calculate the probability of getting at least one head.

....

c) If we had getting at least one tail, what is the probability that we have TT ?

....

....

....

(2.5 marks)
Question 9: If we have Ω a space of elementary events, A and $B \in 2^{\Omega}$ with $P(A)=0.45$, $P(A \setminus B)= 0.25$ and $P(B \setminus A)=0.25$. Then calculate the following probabilities:

a) $P(A \cap B) =$ ....

b) $P(B)=$ ....

c) $P(A \cup B)=$ ....

d) $P(\bar{A} \cup \bar{B}) =$ ....

e) Are the events A and B independent? and why?

....

....

(3.5 marks)

Question 10: We select **three** books randomly (one after another) from a shelf containing **3** Mathematics books, **4** Physics books and **3** Chemistry books. If all books have the same chance at selecting, then:

a) If A is the event that the selected books are Physics, then calculate $P(A)$.

....

....

....

b) let B be the event that the selected books have the same type of subjects, then calculate $P(B)$.

....

....

....

c) What is the probability that the selected books are Mathematics, Physics and Chemistry books?

....

....

....

(4.5 marks)

Question 11: Suppose that $\Omega = \{2,3,7,9,13,16,20,23\}$, $\mathscr{A} = 2^{\Omega}$ and $P(A) = \dfrac{|A|}{|\Omega|}$, and let $X : \Omega \longrightarrow \mathbb{R}$ be a random variable on the probability space $[\Omega, \mathscr{A}, P]$ defined by $X(\omega) = \begin{cases} 1 & \text{if } \omega \text{ is a prime number} \\ 0 & \text{otherwise} \end{cases}$

Then:

a) What is the name of this random variable?

....

b) Calculate the probability $P(X > 7.5)$.

....

c) Determine the event in the relation: $\{\omega \in \Omega \,;\, X(\omega) \le x\} = \begin{cases} \ldots\ldots\ldots\ldots\ldots\ldots & \text{for } x < 0 \\ \ldots\ldots\ldots\ldots\ldots\ldots & \text{for } \quad \le x < \\ \ldots\ldots\ldots\ldots\ldots\ldots & \text{for } x \ge 1 \end{cases}$

d) Determine the distribution function F_X and sketch it.

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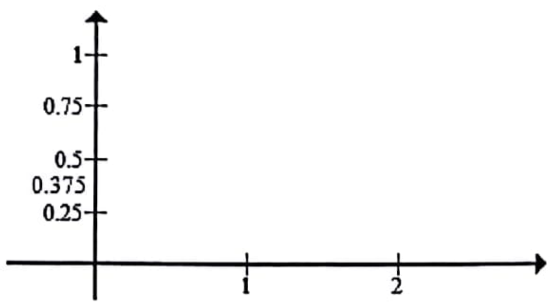
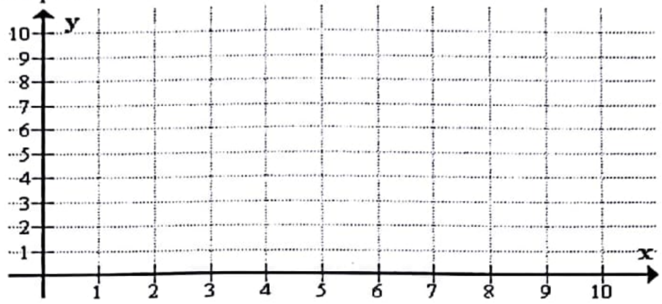


(3 marks)

Question 12: Consider the following data of pairs $(x_i, y_i); i = 1, 2, \ldots, 10$:

X	9	2	3	3	4	2	8	7	5	9
Y	9	3	2	4	3	2	7	8	5	8

a) Represent this data on the scatter plot.



b) If you know that $\sum_{i=1}^{10} x_i = 52$, $\sum_{i=1}^{10} y_i = 51$, $\sum_{i=1}^{10} x_i^2 = 342$, $\sum_{i=1}^{10} y_i^2 = 325$, $\sum_{i=1}^{10} x_i y_i = 330$, $\sum_{i=1}^{10} (x_i - \bar{x})^2 = 71.6$,

$\sum_{i=1}^{10} (y_i - \bar{y})^2 = 64.9$ and $\sum_{i=1}^{10} (x_i - \bar{x})(y_i - \bar{y}) = 64.8$. Then calculate the coefficient of correlation (**r**).

....

....

....

....

c) Is there a linear relationship between X and Y? Is it positive or negative ? Is it strong or weak ?

....

....

(3 marks)

Question 13: Assume that a researcher collected a random sample of size **100** from students and found **9** of them are excellent. Then:

a) Determine **96%** confidence interval for the proportion of excellent students. **(Z-Table on the next page)**

....

....

....

....

b) If the point estimation $\hat{p}$ is used to estimate p, what is the margin error (for **96%** confidence level) ?

....

....

c) If the margin error $\delta_p = 0.05$ (for 96% confidence level), what is the sample size n ?

....

....

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974

(2.5 marks)
Question 14: A tire factory claimed that, by significance level $\alpha = 0.011$, its tires endure **100000** Km (Kilometer). A random sample of size **64** was subjected, and we found that the average of tires endure was **95000** Km with standard deviation **18000** Km. What is your reply to the factory claim ?

Solution:

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End of Exam

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(2 marks)

Question 1: Classify each variable as Qualitative or Quantitative.	**The answer**
The variable that records height of buildings in a city.	
The variable that records size (**S, M, L, …**) of **T**-shirts in stores.	
The variable that records the type of trees.	
The variable that records length of revers in continents.	

(2 marks)

Question 2: Classify each variable as Continuous or Discrete.	**The answer**
The variable that records number of books in libraries.	
The variable that records age of people.	
The variable that records number of commercial markets in Riyadh neighborhoods.	
The variable that records height of children in schools.	

(2 marks)

Question 3: Determine whether of the following statements is True or False.	**The answer**
Two events A and B are mutual exclusive if $P(A \cap B) = P(A) + P(B)$.	
The standard deviation is a measure for tendency measure.	
$100(1-\alpha)\%$ confidence interval for the proportion population p is $\hat{p} \mp z_{1-\alpha}\sqrt{\dfrac{\hat{p}(1-\hat{p})}{\hat{p}}}$.	
For a normal population, the statistic $\overline{X}$ is an estimator for the mean population μ .	

(2 marks)

Question 4: Put the right word or symbol in its proper position:

$Q_1 - Q_3$, $x_\ell - x_s$, $x_k - x_1$, $Q_3 - Q_1$, $P(A) = \varnothing$, $P(A) = 0$, $P(A \cup B) = P(A) + P(B)$, $P(A \cap B) = P(A) \cdot P(B)$, $Z = \dfrac{\overline{X} - \mu_0}{\sigma / \sqrt{n}}$, $z_0 = \dfrac{\overline{x} - \mu_0}{\sigma / \sqrt{n}}$, $Z = \dfrac{\hat{P} - p_0}{\sqrt{p_0(1-p_0) / n}}$, $z_0 = \dfrac{\hat{p} - p_0}{\sqrt{p_0(1-p_0) / n}}$.

Two events A and B are independent if ……………………………….

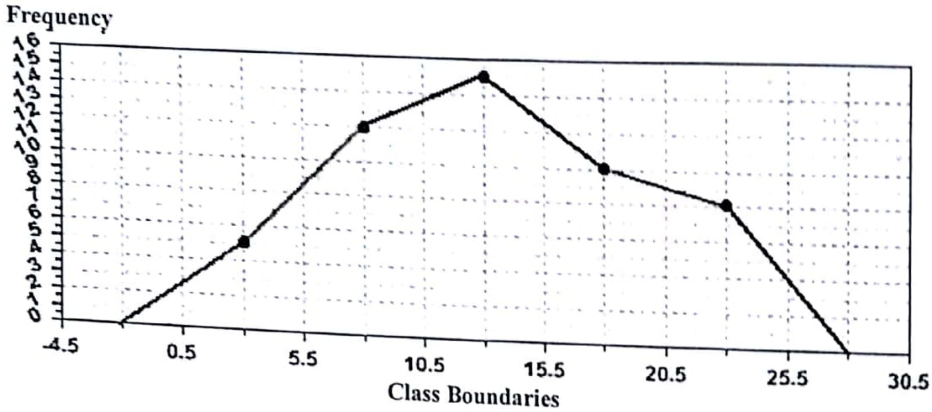
The interquartile range of data is ……………………………….

If A is an impossible event, then ………………………………. .

The value of test statistic for the proportion population is ……………………………….

(8 marks)

Question 5: Consider data given by the following frequency polygon:



Then:

a) Complete the following frequency distribution table for the data of above polygon.

Class Boundaries	Midpoint	Frequency	Relative Frequency	Percentage Frequency	Ascending Cumulative Frequency (ACF)
0.5 → 5.5					
5.5 → 10.5					
10.5 → 15.5					
15.5 → 20.5					
20.5 → 25.5					
Sum					

b) Calculate the **median** for the data of above frequency distribution table.

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c) Calculate the **range** of data for the above frequency distribution table.

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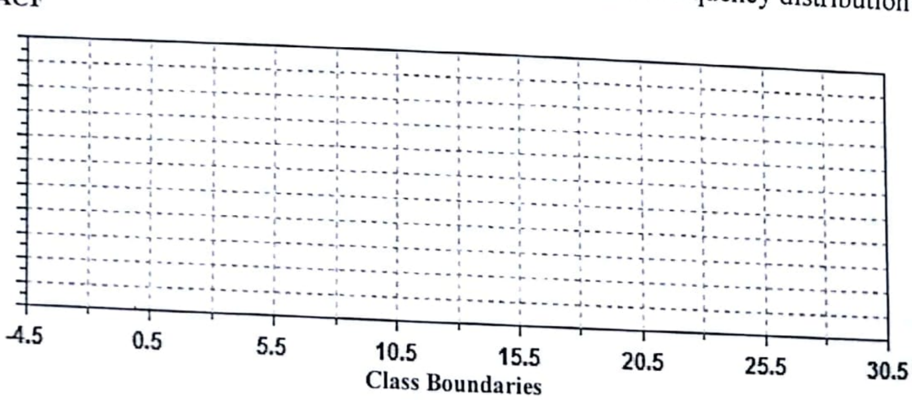
d) Draw the **ascending cumulative frequency polygon (ogive)** of the above frequency distribution table.



(10 marks)

Question 6: Consider the following ordered data:

$-3 \quad -2 \quad -1 \quad 1 \quad 2 \quad 3 \quad 5 \quad 7 \quad 11 \quad 17$

Then:

a) Calculate the **mean** for the given data.

b) Find the **mode(s)** of the given data.

c) If the variance of the given data is $S^2 = 39.11$, then calculate the **standard score** for the value **11.**

d) Calculate the **coefficient of variation** for the given data.

e) Calculate Q_1, D_5, P_{75}, **LF** and **HF** for the given data.

For Q_1 :

For D_5 :

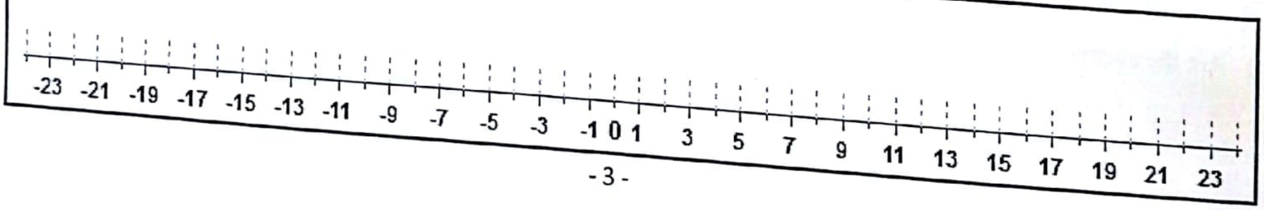
For P_{75} :

For LF :

For HF :

f) Check if the given data have **outliers.**

g) Draw the **box plot** for the given data and determine the **five numbers** on the graph:

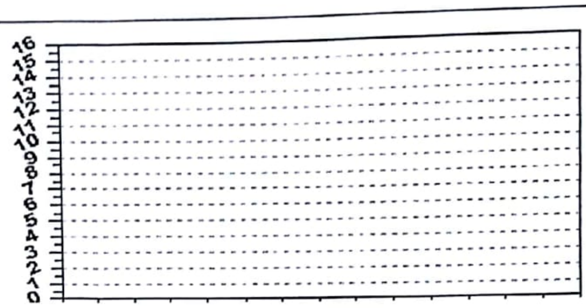


(2 marks)
Question 7: The following data represent the blood groups of people:

B	A	O	A	B	AB	O	O	A	AB	B	B
AB	O	AB	B	O	O	O	AB	AB	O	AB	B
B	A	O	B	O	AB	A	B	B	AB	B	A
O	B	B	O	O	A	O	A	AB	A	B	A

Then write the frequencies of the blood groups in the following table and represent them graphical.

Blood Group	Frequency
O	
A	
B	
AB	
sum	



(2.5 marks)
Question 8: If $[\Omega, \mathscr{A}, P]$ is a probability space of rolling a **fair die** one time, then:

a) Determine Ω, $\mathscr{A}$ and P for this random experiment.

....

b) Calculate the probability of getting a number greater than 2.

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c) If we get an odd number, what is the probability that we have the number 1 ?

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(3 marks)
Question 9: If we have Ω a space of elementary evens, A and $B \in 2^{\Omega}$ with $P(A) = \mathbf{0.40}$, $P(B) = \mathbf{0.45}$, $P(A \cup B) = \mathbf{0.65}$.
Then calculate the following probabilities:

a) $P(A \cap B) =$ ....

b) $P(A \cap \bar{B}) =$ ....

c) $P(B \mid A) =$ ....

d) $P(\bar{A} \cap \bar{B}) =$ ....

e) Are the events A and B independent? and why?

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(3 marks)

Question 10: We select **four** balls randomly (at the same time) of a box contains **5 black**, **4 green** and **1 red** balls.

If all balls have the same chance at selecting. Now:

a) If A is the event that the selected balls are **2** black and **2** green, then calculate $P(A)$.

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b) If B is the event that the selected balls have three colors, then calculate $P(B)$.

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c) What is the probability that the selected balls have the same color ?

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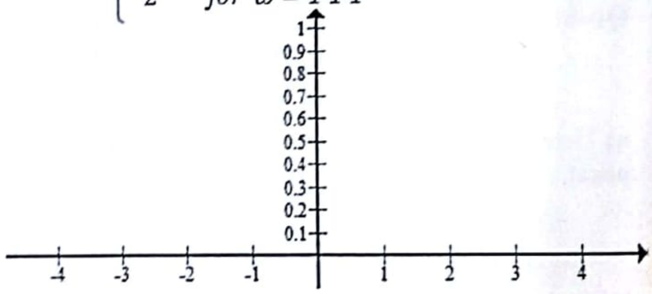
(4 marks)

Question 11: Suppose that $\Omega = \{HHH, HHT, HTT, TTT\}$, $\mathscr{A} = 2^{\Omega}$ and $P(A) = \frac{|A|}{|\Omega|}$. Now, let X be a random variable on the probability space $[\Omega, \mathscr{A}, P]$ defined by: $X(\omega) = \begin{cases} -3 & for\ \ \omega = HHH \\ 1 & for\ \ \omega = HHT, HTT \\ 2 & for\ \ \omega = TTT \end{cases}$

Then:

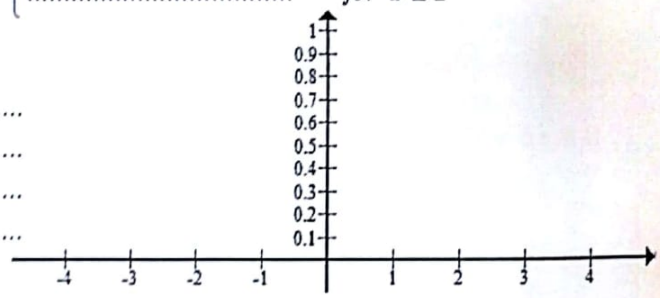
a) Represent this random variable graphical.



b) Determine the event in the relation: $\{\omega \in \Omega\ ; X(\omega) \le x\} = \begin{cases} \dots\dots\dots\dots & for\ \ x < -3 \\ \dots\dots\dots\dots & for\ \ -3 \le x < 1 \\ \dots\dots\dots\dots & for\ \ 1 \le x < 2 \\ \dots\dots\dots\dots & for\ \ x \ge 2 \end{cases}$

c) Determine the distribution function F_X and sketch it.

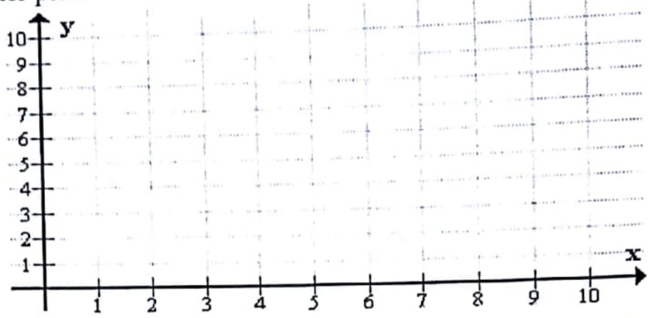
$F(x) = \begin{cases} \dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots \\ \dots\dots\dots\dots\dots\dots \end{cases}$



(3 marks)
Question 12: Consider the following data for a pair of variables X and Y:

X	3	2	1	7	7	6	5	8	9	10
Y	7	5	10	3	4	4	5	2	2	1

a) Represent this data on the scatter plot.



b) If you know that $\sum_{i=1}^{10} x_i = 58$, $\sum_{i=1}^{10} y_i = 43$, $\sum_{i=1}^{10} x_i^2 = 418$, $\sum_{i=1}^{10} y_i^2 = 249$, $\sum_{i=1}^{10} x_i y_i = 183$, $\sum_{i=1}^{10}(x_i - \overline{x})^2 = 81.6$,

$\sum_{i=1}^{10}(y_i - \overline{y})^2 = 64.1$ and $\sum_{i=1}^{10}(x_i - \overline{x})(y_i - \overline{y}) = -66.4$. Then calculate the coefficient of correlation (**r**).

r = ...

....

....

c) Is the relationship between X and Y linear? Positive or negative? Strong or weak ?

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(3.25 marks)
Question 13: A factory produce a kind of light bulbs. It claims by 95% confidence level, that the mean lifetime of the lamps has $\mu = 500$ hours working with standard deviation $\sigma = 5$ working hours. We select a sample of 36 bulbs and find that the mean lifetime of the lamps equal to 480 hours working. Then:

a) Determine 95% confidence interval for the mean lifetime. **(The standard normal distribution table is on the next page).**

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b) If the sample size equal to 100, what is the value for the margin error δ_μ ?

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c) If the margin error $\delta_\mu = 0.15$ (for the 95% confidence level), what is the sample size which we use ?

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A standard normal distribution table

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952

(3.25 marks)

Question 14: An economist thinks that at least 70 percent of recently arrived immigrants who have been working in the health profession in a country for more than one year feel that they are underemployed with respect to their training. Suppose a random sample of size **560** indicated that **415** individuals felt they were underemployed. Then:

a) Is this strong enough evidence, at the significance level $\alpha = \mathbf{0.0192}$, to prove that the economist is correct ?

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b) What about at the level of significance $\alpha = \mathbf{0.0394}$?

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(2 marks)

Question 1: Classify each variable as Qualitative or Quantitative.	**The answer**
The variable that records length of roads in the city.	
The variable that records distance between countries.	
The variable that records types of pens.	
The variable that records colors of flowers.	

(2 marks)

Question 2: Classify each variable as Continuous or Discrete.	**The answer**
The variable that records numbers of students in schools.	
The variable that records age of people in KSA.	
The variable that records heights of buildings in the university.	
The variable that records numbers of integer numbers in intervals of real numbers.	

(2 marks)

Question 3: Determine whether of the following statements is True or False.	**The answer**
$F_X(x) = P(X \le x)$ for some $x \in \mathbb{R}$.	
The mean of data is sensitive to extreme values.	
If $\mathscr{A}$ is an algebra on Ω, then $\varnothing \in \mathscr{A}$.	
The statistic $\bar{X}$ is an estimator for the variance σ^2 of a normal population.	

(2 marks)

Question 4: Put the right word or symbol in its proper position: **parameter, $\mathscr{A} \in \Omega$, statistic, $\Omega \in \mathscr{A}$, permutation, combination, independent, mutual exclusive.**
Two events A and B are ……………………………… if they have not common elementary events.
Selection r distinct objects from a set of n different objects, is called a ……………………………… .
If a $\mathscr{A}$ is an algebra on Ω, then ……………………………… .
The point estimation is an estimate of the population ………………………………by a single number.

(7 marks)

Question 5 Consider the following data:

7	16	7	12	13	2	12	21	17	4	2	16	11
16	7	11	10	8	9	8	6	22	17	7	14	22
12	6	6	1	15	17	11	11	25	1	12	13	16
12	18	23	17	8	13	22	21	21	15	18		

Then:

a) **Complete** the following frequency distribution table for the given data:

Class Limit	Class Boundaries	Midpoint	Frequency	Ascending Cumulative Frequency (ACF)
	$0.5 \rightarrow 5.5$			
	$5.5 \rightarrow 10.5$			
	$10.5 \rightarrow 15.5$			
	$15.5 \rightarrow 20.5$			
	$20.5 \rightarrow 25.5$			
Sum				

b) Calculate the **median** for the data of above frequency distribution table.

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c) Calculate the **range** of data for the above frequency distribution table.

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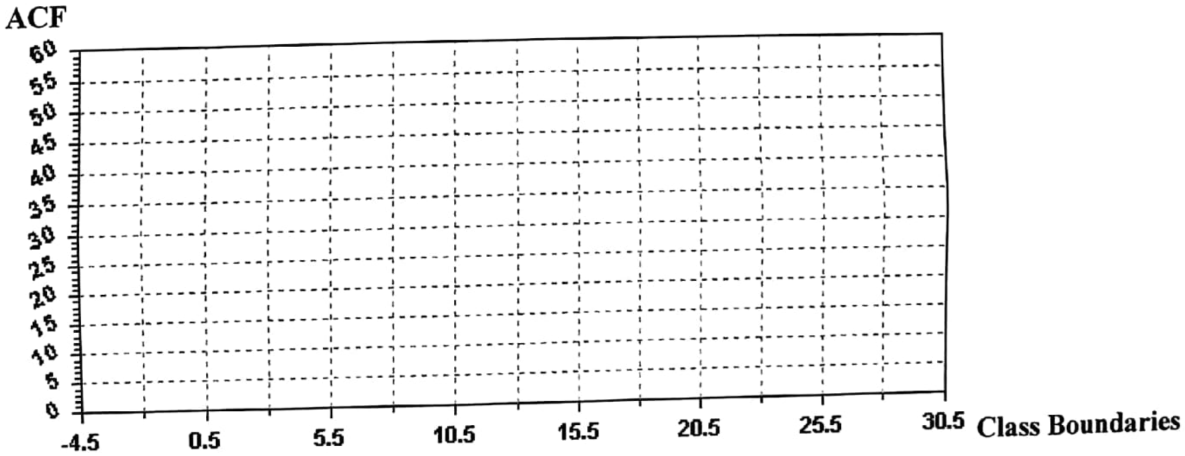
d) Draw the **ogive** (ascending cumulative polygon) of the above frequency distribution table.



(10 marks)

Question 6 Consider the data: **9 , 5 , 3 , 9, 5, 7 , 1 , 7, 6, 16, 9.** Then:

a) Calculate the **mean** for the given data.

b) Calculate the **median** for the given data.

c) Find the **mode** of the given data.

d) If the standard deviation of the given data is $S = 3.92$, then calculate the **standard score** for the value 6.

e) Calculate the **coefficient of variation** for the given data.

f) Calculate Q_1, Q_3, LF and HF for the given data.

For Q_1 :

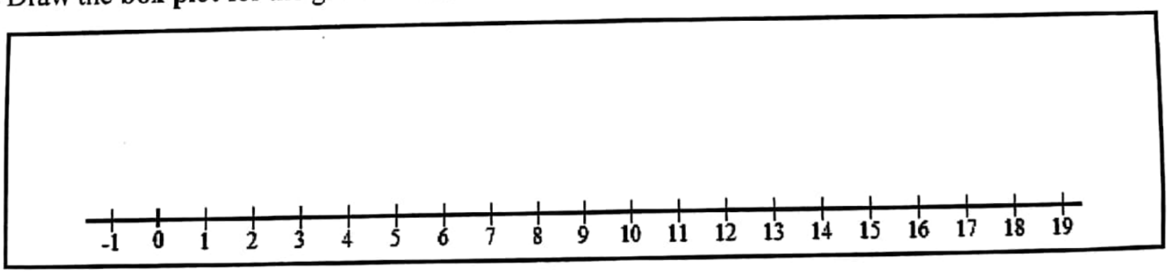
For Q_3 :

For LF :

For HF :

g) Check if the given data have **outliers**.

h) Draw the **box plot** for the given data and determine the five numbers on the graph:



(3.5 marks)
Question 7: The following data represent the grades of students:

A	**C**	**C**	**A**	**B**	**C**	**B**	**A**	**D**	**B**
D	**B**	**C**	**D**	**B**	**A**	**C**	**A**	**D**	**C**
A	**B**	**A**	**D**	**C**	**B**	**B**	**C**	**D**	**B**
B	**B**	**B**	**A**	**A**	**B**	**C**	**B**	**A**	**A**

Then:

a) Complete the frequency table for the above data.

Grade	Frequency	Relative Frequency	Percentage
A			
B			
C			
D			
sum			

b) For the above data, calculate the measure angles of categories of the **pie chart.**

For category (A) the measure angle = (   )(   ) =

For category (B) the measure angle = (   )(   ) =

For category (C) the measure angle = (   )(   ) =

For category (D) the measure angle = (   )(   ) =

(2.5 marks)
Question 8: If $[\Omega, \mathscr{A}, P]$ is a probability space of tossing a **fair coin** three times, then:

a) Determine Ω, $\mathscr{A}$ and P for this random experiment.

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b) Calculate the probability of getting at most one tails.

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c) Calculate the probability of getting three heads or three tails.

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(3 marks)

Question 9: We select **three** balls randomly and at the same time of a box contains **4 black** and **3 green** balls. If all balls have the same chance at selecting. Now:

a) If A is the event that the selected balls are black, then calculate $P(A)$.

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b) If B is the event that the selected balls have the same colors, then calculate $P(B)$.

....

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c) What is the probability that the selected balls have different colors?

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(3.5 marks)

Question 10: Suppose that $\Omega = \{1,2,3,4,5,6\}$, $\mathscr{A} = 2^{\Omega}$ and $P(A) = \frac{|A|}{|\Omega|}$. Now, let $X : \Omega \longrightarrow \mathbb{R}$ be a random variable on the probability space $[\Omega, \mathscr{A}, P]$ defined by $X(\omega) = \begin{cases} 0 & for\ \omega = 1,3,5 \\ 1 & for\ \omega = 2,4,6 \end{cases}$

Then:

a) What is the name of this random variable and calculate the probability $P(X = 0)$?

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b) Determine the event in the relation: $\{\omega \in \Omega\ ;\ X(\omega) \le x\} = \begin{cases} \ldots\ldots\ldots & for\ x < 0 \\ \ldots\ldots\ldots & for\ 0 \le x < 1 \\ \ldots\ldots\ldots & for\ x \ge 1 \end{cases}$

c) Determine the distribution function F_X and draw it.

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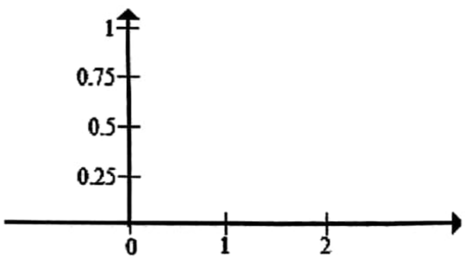

(3 marks)

Question 11: If we have Ω a space of elementary evens, A and $B \in 2^{\Omega}$ with $P(A \cap B) = 0.10$, $P(A \cup B) = 0.75$ and $P(\bar{A}) = 0.65$. Then calculate the following probabilities:

a) $P(B) =$ ....

....

b) $P(A \setminus B) =$ ....

c) $P(\bar{A} \cap \bar{B}) =$ ....

d) $P(A \mid B) =$ ....

....

e) Are the events A and B independent? and why?

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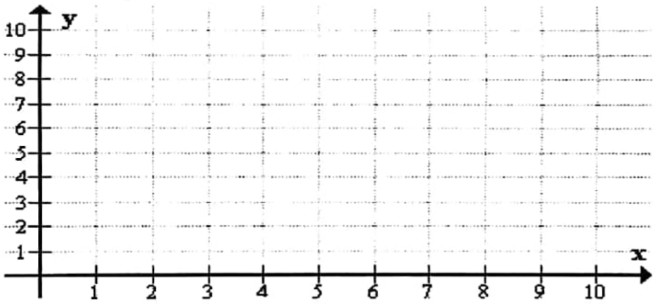
(3 marks)

Question 12: The results of 10 students on Stat quiz marks (X) and Math quiz marks (Y) are as follows:

X	**2**	**4**	**5**	**5**	**6**	**7**	**7**	**8**	**1**	**9**
Y	**4**	**5**	**6**	**7**	**7**	**7**	**8**	**9**	**3**	**10**

a) Represent this data on the scatter plot.



b) If you know that $\sum_{i=1}^{10} x_i = 54$, $\sum_{i=1}^{10} y_i = 66$, $\sum_{i=1}^{10} x_i^2 = 350$, $\sum_{i=1}^{10} y_i^2 = 478$, $\sum_{i=1}^{10} x_i y_i = 405$, $\sum_{i=1}^{10} (x_i - \bar{x})^2 = 58.4$, $\sum_{i=1}^{10} (y_i - \bar{y})^2 = 42.4$ and $\sum_{i=1}^{10} (x_i - \bar{x})(y_i - \bar{y}) = 48.6$. Then calculate the coefficient of correlation (**r**).

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c) Is the relationship between X and Y linear? Positive or negative? Strong or weak?

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(1.5 marks)

Question 13: We suppose that the number of defects in newly manufactured bulbs in each working shift is a normal distributed random variable X with a mean $\mu = 5$ and standard deviation $\sigma = 1.25$. Now, consider that in one of the working shifts a random sample of new bulbs is tested. What is the sampling distribution of $\overline{X}$ based on sample of size 144.

(5 marks)

Question 14: A simple random sample of 81 students from a university yields mean GPA (Grade Point Average) 3.4 with standard deviation 0.75. Then:

a) Determine 95% confidence interval for the mean GPA of all students at the university.

b) Using the significance level $\alpha = 0.0099$ for testing the null hypothesis $H_0 : \mu = 3$ versus the alternative hypothesis $H_1 : \mu > 3$.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964

End of Exam