



MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR FIRST SEMESTER EXAMINATIONS FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECU 201: ENGINEERING MATHEMATICS VI

DATE:

TIME:

INSTRUCTIONS: Answer question ONE and any other TWO questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Differentiate the following terms;

(i) Inclusive and exclusive class intervals.

(2 marks)

(ii) Qualitative and quantitative data.

(2 marks)

(iii) Discrete and continuous random variables

(2 marks)

(b) A discrete random variable x has a probability function given by:

x	0	1	2	3	4	5
$f(x)$	0.10	0.15	$2k$	0.25	k	0.05

(i) Find the value of k

(2 marks)

(ii) Determine the mean and the variance of the random variable X

(4 marks)

(iii) Determine the probability that x is at least 3.

(2 marks)

c) A construction company receives an average of four inquiries per week. Determine the probability that the number of enquiries in a week will be exactly 2

(3 marks)

- d) A binomial random variable has $\mu = 50$ and S.D =5, find the values of n and p (2 marks)
- e) Suppose that the probability that it is raining when you go into college is $\frac{1}{3}$ and that it is not raining when you come out of it is $\frac{1}{6}$, what is the probability that it is raining in both occasions. (3 marks)
- f) Compute the Geometric mean from the frequency distribution shown below, (4 marks)

Diameter(mm)	5	10	15	20	25	30
Frequency(f)	4	9	16	12	6	3

- g) From the frequency distribution below, draw a histogram and estimate the mode (4 marks)

Diameter(mm)	10-12	13-15	16-18	19-21	22-24	25-27
Frequency(f)	2	7	12	5	3	1

QUESTION TWO (20 MARKS)

- a) Given that $f(x) = \begin{cases} e^{-x} & x > 0 \\ 0 & \text{elsewhere} \end{cases}$ find the moment generating function and use it to find the mean (5 marks)
- b) Two dice are thrown. What is the probability that the sum of the two faces is a multiple of 3 (5 marks)

The table shows marks scored by 80 students in an examination. If the modal mark is 52, determine the values of x and y . (5 marks)

marks	0-20	20-40	40-60	60-80	80-100
No. of students	17	x	20	y	8

- a) Given the frequency distribution below, find; 1st quartile and the 6th Decile. (5 marks)

marks	10-15	15-20	20-25	25-30	30-35	35-40
Frequency(f)	20	15	31	22	10	2

QUESTION THREE (20 MARKS)

- a) Show that the mean and variance of a Poisson distribution is λ . (7 marks)
- b) The number of people who become ill each year from eating a kind of poisonous plant in a certain region is a random variable having a Poisson distribution with $\lambda = 1.6$, find the probability of;
- 2 such illnesses in a given year.
 - At least 3 such illnesses in 5 years
- (7 marks)
- c) A bag contains 3 blue balls, 4 red balls and 5 green balls. Two balls are drawn in turn from the bag without replacement. Find the probability that a balls picked at random from the bag are;
- Both green
 - A Blue and a red
- (6 marks)

QUESTION FOUR (20 MARKS)

- a) The data given in table below shows temperatures and the time it takes for a concrete mixture to dry up.

Temp	15	16	18	22	14	25	17	28	30	26
Time	21	20	18	16	24	15	18	14	12	14

- Compute the Pearson's product moment correlation coefficient ' r ' and hence comment on the relationship between temperature and the time it takes for the mixture to dry. (10 marks)
- b) The marks scored in ECU 210 by students who sat for the examination in a certain year has been found to be normally distributed with mean 54 marks and a standard deviation 12 marks.
- Determine the proportion of the students who passed if the pass-mark was set at 45 marks. (4 marks)
 - Determine the proportion of the students who scored a credit grade if a credit is assigned for marks between 60 and 74. (3 marks)
 - If the top 65% of the students are supposed to pass the examination, determine the mark which should be set as the pass-mark to achieve this. (3 marks)

QUESTION FIVE (20 MARKS)

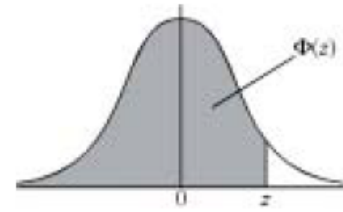
- a) Given that $f(x) = \begin{cases} \frac{c}{\sqrt{x}}, & 0 < x < 4 \\ 0, & \text{elsewhere} \end{cases}$, find the value of c and mean of x . (6 marks)
- b) The probability that a car will break down while driving through a certain tunnel is 0.0004. Find the probability that among 2000 cars driving through the tunnel, at most one will break down. (5 marks)
- c) In a construction company, 52% of the workers have a degree. 5 workers were selected at random. Determine the probability that;
- i. Exactly 3 have a degree. (3 marks)
 - ii. 3 or less have a degree. (3 marks)
 - iii. At least one has a degree given that not more than 3 have a degree. (3 marks)

THE NORMAL DISTRIBUTION FUNCTION

If Z has a normal distribution with mean 0 and variance 1 then, for each value of z , the table gives the value of $\Phi(z)$, where

$$\Phi(z) = P(Z \leq z).$$

For negative values of z use $\Phi(-z) = 1 - \Phi(z)$.



z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
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0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359	4	8	12	16	20	24	28	32	36
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753	4	8	12	16	20	24	28	32	36
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141	4	8	12	15	19	23	27	31	35
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517	4	7	11	15	19	22	26	30	34
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879	4	7	11	14	18	22	25	29	32
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224	3	7	10	14	17	20	24	27	31
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549	3	7	10	13	16	19	23	26	29
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852	3	6	9	12	15	18	21	24	27
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133	3	5	8	11	14	16	19	22	25
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389	3	5	8	10	13	15	18	20	23
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621	2	5	7	9	12	14	16	19	21
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830	2	4	6	8	10	12	14	16	18
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015	2	4	6	7	9	11	13	15	17
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177	2	3	5	6	8	10	11	13	14
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319	1	3	4	6	7	8	10	11	13
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441	1	2	4	5	6	7	8	10	11
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545	1	2	3	4	5	6	7	8	9
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633	1	2	3	4	4	5	6	7	8
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706	1	1	2	3	4	4	5	6	6
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767	1	1	2	2	3	4	4	5	5
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817	0	1	1	2	2	3	3	4	4
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857	0	1	1	2	2	2	3	3	4
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890	0	1	1	1	2	2	2	3	3
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916	0	1	1	1	1	2	2	2	2
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936	0	0	1	1	1	1	1	2	2
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952	0	0	0	1	1	1	1	1	1
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964	0	0	0	0	1	1	1	1	1
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974	0	0	0	0	0	1	1	1	1
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981	0	0	0	0	0	0	0	1	1
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986	0	0	0	0	0	0	0	0	0