



UNIVERSITY OF EMBU

2017/2018 ACADEMIC YEAR

SECOND SEMESTER EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR ECONOMICS AND STATISTICS, BACHELOR OF SCIENCE (STATISTICS) AND BACHELOR OF SCIENCE

STA 101 /SMA 140: INTRODUCTION TO PROBABILITY AND STATISTICS

DATE: APRIL 6, 2018

TIME: 2:00 PM – 4:00 PM

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions.

QUESTION ONE (30 MARKS)

- a) Outline **four** characteristics of the normal probability distribution. (2 marks)
- b) 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)
- c) 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)
- d) State the laws of probability. (2 marks)
- e) A binomial random variable has $\mu=50$ and standard deviation =5, find the values of n and p (4 marks)
- f) Distinguish between discrete and continuous random variables (2 marks)
- g) compute the geometric mean from the frequency distribution shown below, (5 marks)

Diameter(mm)	5-9	10-14	15-19	20-24	25-29	30-34
Frequency(f)	4	9	16	12	6	3

h) From the frequency distribution below, draw a histogram and estimate the mode

(4 marks)

Mass (kg)	20-29	30-39	40-49	50-59	60-69
frequency	2	4	1	6	3

QUESTION TWO (20 MARKS)

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

x	0	1	2	3	4	5
$f(x)$	0.10	0.15	0.30	0.25	0.15	0.05

i) Show that the function $f(x)$ is a probability mass function (p.m.f.). (2 marks)

ii) Determine the mean and the variance of the random variable x in the probability distribution. (7 marks)

iii) Determine the probability that x is at least 3. (2 marks)

b) The probability that I hit the bull's eye in a dart game is 0.12. find the probability in 8 trials, I hit it:

i) Exactly 4 times

ii) At least once.

iii) What is the $E(x)$.

(9 marks)

QUESTION THREE (20 MARKS)

a) Prove that the mean and variance of a Poisson distribution is λ . (8 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;

i) 2 such illnesses in a given year.

ii) At least 7 such illnesses in 5 years

(6 marks)

c) Let X have a p.m.f

$$f(x) = \begin{cases} x/6 & x = 1, 2, 3. \\ 0, & \text{elsewhere} \end{cases}$$

Find the mean and variance of X

(6 marks)

QUESTION FOUR (20 MARKS)

a) Estimate the mean and standard deviation from the frequency distribution shown below,

Diameter(mm)	5-9	10-14	15-19	20-24	25-29	30-34
Frequency(f)	4	9	16	12	6	3

(10 marks)

b) The daily water usage per person in Mwea is normally distributed with a mean of 20 gallons and a standard deviation of 5 gallons. What is the probability that a person from Mwea selected at random will use;

- i) Less than 20 gallons per day?
- ii) More than 30 gallons per day?
- iii) What percent of the population uses between 25 and 30 gallons?

(10 marks)

QUESTION FIVE (20 MARKS)

a) As part of an air-pollution survey, an inspector decides to examine the exhaust of six of a company's 24 trucks. If 4 of the company's trucks emit excessive amounts of pollutants, what is the probability none of them will be included in the inspector's sample? (10 marks)

b) The table shows marks scored by 80 students in an examination. If the modal mark is 52 determine the values of x and y . Hence determine the median mark. (10 marks)

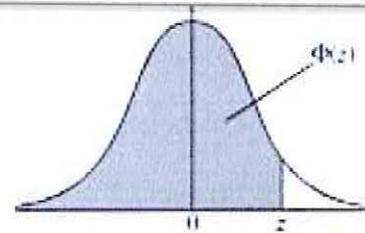
marks	0-20	20-40	40-60	60-80	80-100
No. of students	17	x	20	y	8

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											ADD								
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
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

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