UNIVERSITY OF COLOMBO

FACULTY OF GRADUATE STUDIES

Postgraduate Diploma in Business Management (Semester- I) Examination- March, 2019

PGDBM-5103 Quantitative Techniques

Time: Three (03) Hours

Answer any FIVE (05) questions.

The use of Calculators is allowed

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1. i. You have chosen a sample of 25 super markets out of the 580 you have responsibility for. These 25 have been inspected, and the number of violations of company policy has been recorded. For each of the following quantities, state whether it is a statistic or a parameter.

a. The average number of violations among the 25 supermarkets you inspected.
b. The mean number of violations you would have recorded had you inspected all 580 supermarkets you are responsible for.
c. The variability from one supermarket to another in the population.
d. The variability from one supermarket to another, as measured by the standard deviation you computed.
e. The standard deviation of your sample average.

(05 Marks)

ii. The following frequency distribution shows the number of days absent by 98 employees at ABC Ltd. during the year 2018.

Days Absent	Number of Employees
00-04	05
04-08	23
08-12	35
12-16	17
16-20	13
20-24	05

a. Calculate the mean number of days absent by an employee.

(03 Marks)

b. Determine in terms of days absent (Mode) by most of the employees.

(03 Marks)

c. Determine the standard deviation of this distribution.

(04 Marks)

d. Because the distribution is roughly bell-shaped, between what values would you expect to find 90% of the observations? (03 Marks)

e. If an employee is selected at random find the probability that the employee is absent for more than 16 days.

(02 Marks)

(Total 20 Marks)

2. i. Explain briefly the following terms.

a. Mutually Exclusive and collectively exhaustive Events

b. Conditional Probability

(06 Marks)

ii. During a study of vehicle accidents, police found that 64% of the accidents occur at night. 55% are alcohol related and 33% occur at night and are alcohol related.

a. What is the probability that an accident was alcohol related, given that it occurred at night?

b. What is the probability that an accident occurred at night given that it was alcohol related?

(06 Marks)

iii. A retailer places orders with a number of wholesalers. According to the data collected over a number of months, the following table shows some details about the times taken to receive orders for different amounts.

Amount of Order (Rs)	Number of days from order to receipt		Total
	Under 21	21 or More	
Under 30,000	107	196	303
30,000 -- 80,000	24	55	79
Over 80,000	36	82	118
Total	167	333	500

i. Compute the Marginal probabilities and interpret one of them.

ii. Find the probability that an order of Rs. 80,000 or less will be received in less than 21 days.

iii. If the order value is Rs.30, 000 or more, find the probability that it will take 21 days or more to receive.

(08 Marks)
(Total 20 Marks)

3. i. One of the biggest frustrations for the consumer electronics industry is that customers are accustomed to returning goods for any reason. Recently, it was reported that returns for "no trouble found" were 68% of all the returns. Consider a sample of 20 customers who returned consumer electronics purchases. Use the binomial model to answer the following questions:

a. What is the expected value, or mean, of the binomial distribution?

b. What is the standard deviation of the binomial distribution?

c. What is the probability that 15 of the 20 customers made a return for "no trouble found"?

d. What is the probability that less than two of the customers made a return for "no trouble found"?

(08 Marks)

ii. Suppose the average speeds of passenger trains traveling from Colombo, Anuradhapura, Vauniya to Jaffna, are normally distributed, with a mean average speed of 88 km per hour and a standard deviation of 6.4 km per hour.

a. What is the probability that a train will average less than 70 km per hour?

b. What is the probability that a train will average more than 80 km per hour?

c. What is the probability that a train will average between 90 and 100 km per hour?

(12 Marks)
(Total 20 Marks)

4. i. Explain the following concepts using suitable numbers and scatter diagrams.

a. Approximately zero correlation

b. Perfect correlation

c. Weak positive correlation

d. Strong negative correlation

(08 Marks)

ii. The following table shows the net profit in rupees and the number of employees per store in 2018 for an organization.

Net profit (000)	22	30	20	25	18	26	22	19
No of employees	3	6	4	5	2	5	4	1

a. Find the correlation coefficient of the variables given and interpret it.

b. Estimate the least square regression of number of employees on net profit.

c. What is the expected profit if 7 employees per store are employed?

d. What is the validity of your forecast in part (c).

(12 Marks)

(Total 20 Marks)

5. i. A firm has the following total cost and inverse demand functions:

$$TC = 2Q^2 + 6Q + 216$$
$$P = 120 - Q$$

Where Q is the quantity produced and P is the selling Price.

a. What output leads to the highest level of revenue from sales?

b. Find the marginal revenue at Q=12 and marginal cost at Q=15.

c. For what output level is marginal revenue the same as marginal cost?

d. Determine the profit maximizing output and the maximum profit?

(15 Marks)

ii. A firm's marginal cost function is given as

$$MC = 3x^2 - 42x + 360$$

The firm is currently producing 12 units per day. What will be the additional cost if the firm decides to produce 15 units per day?

(05 Marks)

(Total: 20 Marks)

6. Select any four (04) and explain the difference between the two concepts.

i. Descriptive Statistics and Inferential Statistics.

ii. Systematic sampling and Stratified sampling.

iii. Confidence interval and Level of significance.

iv. Bayes Theorem and Conditional Probability.

v. Null hypothesis and Alternative hypothesis

(05 marks each)
(Total: 20 Marks)

Statistical Formula sheet:

$$\overline{X} = \frac{\sum_{i=1}^{n} fX_i}{n}$$

S= $\sqrt{\frac{\sum f(X-\bar{X})^2}{n-1}}$

Mode=

$$E(X) = \sum_{i=1}^{N} X_i P(X_i)$$

$$\sigma = \sqrt{\sum_{i=1}^{N} [X_i - E(X)]^2 P(X_i)}$$

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$$

$$Z = \frac{X - \mu}{\sigma}$$

$$P(X) = \frac{n!}{X!(n-X)!} p^X (1-p)^{n-X}$$

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

$$r = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2] \times [n\Sigma y^2 - (\Sigma y)^2]}}$$

$$r = \frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\sqrt{\Sigma(X-\bar{X})^2 \Sigma(Y-\bar{Y})^2}}$$

$$\beta_1 = \frac{n\Sigma xy - \Sigma x \Sigma y}{[n\Sigma x^2 - (\Sigma x)^2]}$$

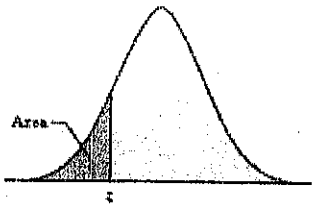
$$\beta_0 = \frac{\Sigma y}{n} - b\frac{\Sigma x}{n}$$

$$\hat{\beta}_1 = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sum (x_i - \bar{x})^2} \text{ and } \hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

$$SST = \sum (Y_i - \bar{Y})^2$$

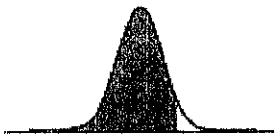
$$SSR = \sum (\hat{Y}_i - \bar{Y})^2$$

$$r^2 = \frac{SSR}{SST} = \frac{\text{regression sum of squares}}{\text{total sum of squares}}$$



Standard Normal Distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641



a	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
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
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990