



Institute of Certified Management Accountants of Sri Lanka

Technician Stage March 2010 Examination

Examination Date : 3rd April 2010
Examination Time : 9.30 a.m.- 12.30 p.m.

Number of Pages : 08
Number of Questions: 09

Instructions to the Candidates

1. Time allowed is **three (3)** hours
2. Answer **any five(5)** questions
3. Answers should be entirely in the **English** language

<u>Subject</u>	<u>Subject Code</u>
Business Mathematics	(BMT / 503)

Question No. 1 (20 Marks)

- (a) The Income Tax Rate is 8% Mr. A has an income of Rs 60,000/-for the year. He is allowed Rs. 200,000/- free of tax, and does not pay tax for 12% of his income he pays for insurance, which is tax free. How much does Mr. A pay as tax. **(08 Marks)**
- (b) A certain number of persons paid a bill. If there had been 4 fewer persons, each would have paid Rs. 20 more and if there had been 3 more persons, each would have paid Rs. 8 less. Find the number of persons and what each has to pay. **(12 Marks)**
- (Total 20 Marks)**

Question No. 2 (20 Marks)

- (a) Mr. X deposited Rs. 10,000/- in a savings bank that pay interest at a rate of 6% per year compounded quarterly. If the principal and accumulated interests are left in the account, find the total amount in his account, after 8 years and 6 months? **(09 Marks)**
- (b) A company is to distribute Rs. 100,000 in bonuses to its top twenty five sales people. The twenty fifth person in the list will receive Rs. 1,600/-. The difference in bonus money between successively ranked sales people is to be constant. Find the bonus obtained by
- (i) The first person **(06 Marks)**
 - (ii) The tenth person **(05 Marks)**
- (Total 20 Marks)**

Question No. 3 (20 Marks)

- (a) A company manufactures and sells flashlights. For a particular model, market research and financial departments estimate that at a price of Rs. p per unit, the weekly cost and the revenue R (both in thousands of rupees) are given by the equations

$$C = 24 - 8p \text{ and } R = 6p - p^2.$$

- (i) What is the cost at break-even point? **(05 Marks)**
(ii) What is the maximum revenue? **(02 Marks)**
(iii) Sketch the graph (in the answer booklet) of C and R on the same set of coordinate axes. **(05 Marks)**

- (b) A distributor supplied two retail outlets, X and Y with washing machines (W) and refrigerators (R) as shown in the following matrix.

$$\begin{matrix} & W & R \\ X & \begin{bmatrix} 3 & 4 \end{bmatrix} \\ Y & \begin{bmatrix} 8 & 2 \end{bmatrix} \end{matrix}$$

The total cost of these items to X and Y were Rs. 256,000 and Rs. 336,000 respectively. Use a matrix method to find the cost of a washing machine and a refrigerator. **(08 Marks)**

(Total 20 Marks)

Question No. 4 (20 Marks)

A frequency distribution for the duration 06 telephone calls, rounded to the nearest minute, is shown below:

Call duration in minutes	4 – 7	8 – 11	12 – 15	16 – 19	20 – 23	24 – 27
Frequency	4	5	7	2	1	1

- (a) Construct a histogram **(03 Marks)**
(b) Construct an ogive (cumulative frequency distribution) **(04 Marks)**
(c) Compute the mean **(03 Marks)**
(d) Compute the standard deviation **(06 Marks)**
(e) Using the ogive or otherwise find the median **(04 Marks)**
(Total 20 Marks)

Question No. 5 (20 Marks)

- (a) The probability that Ms X gets an offer on the first job she applies for is 0.5 and the probability that she will get an offer on the second job she applies for is 0.6. She thinks that the probability that she will get an offer on both jobs is 0.15.
- (i) Define the events involved and use probability notation to show the probability information given above. **(02 Marks)**
(ii) What is the probability that Ms X gets an offer on the second job given that she received an offer for the first job? **(03 Marks)**
(iii) What is the probability that Ms X gets an offer at least on one of the jobs she applies for? **(03 Marks)**
(iv) Are the job offers independent? Explain your views. **(02 Marks)**

- (b) The demand for a product of a company varies greatly from month to month. Based on the past 2 years of data, the following probability distribution shows the company's monthly demand.

Unit Demand	300	400	500	600
Probability	0.20	0.30	0.35	0.15

- (i) If the company places monthly orders based on the expected value of the monthly demand, what should be the company's monthly order quantity for this product?
(05 Months)
- (ii) Assume that each unit demanded generates Rs. 700 is revenue and that each unit ordered costs Rs. 500. How much will the company gain or lose in a month if it places an order based on your answer to part (a) and where the actual demand for the item is 300 units?
(05 Marks)
(Total 20 Marks)

Question No. 6 (20 Marks)

- (a) In a time – use study 20 randomly selected managers were found to spend, mean of 2.40 hours each day on paper work. The standard deviation of 20 scores is 1.30 hours. Use the t-distribution to construct the 95% confidence interval for the mean time spent on paper work by all managers.
(05 Marks)
- (b) A teacher gives a test and gets normally distributed results with a mean of 50 and a standard deviation of 10. Grades are to be assigned according to the following scheme.
A : Top 10%
B : Scores above the bottom 70% and below the top 10%
C : Scores above the bottom 30% and below the top 30%
D : Scores above the bottom 10% and below the top 70%
E : Bottom 10%
Find the numerical limits for each of grade A, B, C, D and F. **(5 × 03 Marks = 15 Marks)**
(Total 20 Marks)

Question No. 7 (20 Marks)

- (a) With individual queues at its various teller windows, bank X found that the standard deviation for normally distributed waiting in queues on Friday afternoons was 6.2 minutes. The bank experimented with a single main waiting queue and found that for a random sample of 25 customers, the waiting times have a standard deviation of 3.8 minutes. Based on previous studies, we can assume that the waiting times are normally distributed. At $\alpha = 0.05$ Significance level, test the claim that a single queue causes lower variation among the waiting queues.
(10 Marks)
- (b) Two sets of sample waiting queues are given by the table below:

	Multiple Queue System	Single Queue System
Sample Size	25	20
Standard Deviation	3.619	1.841

The above data was calculated by recording the waiting queues of randomly selected customers of Thursday afternoon. On another Thursday, all customers enter a single main waiting queue that feeds the individual teller stations as vacancies occur. Examination of the summary statistics shows that the multiple line system seems to have a higher standard deviation. However is the difference significant? Test at $\alpha = 0.05$ significance level.
(10 Marks)
(Total 20 Marks)

Question No. 8 (20 Marks)

The paired data given below consists of weights of discarded plastic and sizes of households.

x : Plastic in Kg	0.27	1.41	2.19	2.83	2.19	1.81	0.85	3.05
y : Household Size	2	3	3	6	4	2	1	5

- (a) Find the value of the linear correlation coefficient r . Is there any linear correlation between x and y . Discuss your answer. **(12 Marks)**
- (b) Using the sample data in (a) and t-distribution, test the claim of a team of researchers that there is a linear correlation between weights of discarded plastic and households. (Test at $\alpha = 0.05$ significance level) **(08 Marks)**
(Total 20 Marks)

Question No. 9 (20 Marks)

- (a) The average annual demand for an item is 4500 units. Lead time in ordering varies with an average of 4 days and lead time of demand is normally distributed with a standard deviation of 4 units. Order costs are Rs. 200 per order, holding cost is Rs. 500 per unit per year and the shortage cost is Rs. 100 per unit.
- (i) Find the economic order quantity. **(03 Marks)**
- (ii) Based on 300 working days per year, find the recorder point. **(07 Marks)**
- (b) The manager of a cricket team wishes to buy bats and balls costing Rs. 4,800 and Rs. 1,200 each, respectively. At least five bats and ten balls are required and the total cost should not exceed Rs. 72,000. **(10 Marks)**
(Total 20 Marks)

List of Formulae

1. Compound Interest:

$$A = P \left(1 + \frac{i}{100 m} \right)^{mn}$$

Where P = Amount invested at the interest rate $i\%$ per year.

A = Amount accumulated at the end of n years.

m = Number of compounding periods per year.

2. n th term and sum to n terms of an arithmetic:

$$(i) \quad l = a + (n-1)d$$

$$(ii) \quad S_n = \frac{2}{n}(a+l)$$

Where l = n th term

a = first term

d = common difference

S_n = sum to n terms of the series

3. Mean and standard deviation of a data set:

$$\text{Mean} = \bar{x} = \frac{\sum fx}{\sum f}$$

$$\text{Standard Deviation} = \sigma = \frac{\sum fx^2 - (\sum fx)^2/n}{n-1}$$

Where f = frequency of the measurement x

N = total number of measurements

4. Probability

If A and B are two events of the same sample space, then

$$(i) \quad P(B/A) = \frac{P(A \cap B)}{P(A)}$$

$$(ii) \quad P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

5. Expected value:

$$E(x) = \sum xp(x)$$

Where $p(x)$ is the probability of the unit x .

6. Small sample confidence interval:

$$\text{Confidence interval} = \bar{x} \pm \frac{t_{\alpha/2}}{\sqrt{n}} S$$

Where \bar{x} = mean

S = standard deviation

n = sample size

$t_{\alpha/2}$ = critical value of t at the significance level

$n-1$ = degree of freedom

7. χ^2 – Statistic:

$$\chi^2 = \frac{(n-1)S^2}{\sigma^2}$$

Where S = sample standard deviation

σ = population standard deviation

n = sample size

$n-1$ = degree of freedom

8. F – Statistic:

$$F = S_1^2 / S_2^2$$

Where S_1^2 = larger variance

S_2^2 = smaller variance

$n-1$ = degree of freedom from sample size n

9. Linear correlation between x and y :

$$r = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{n \sum x^2 - (\sum x)^2} \sqrt{n \sum y^2 - (\sum y)^2}}$$

Where r = linear correlation coefficient

n = sample size

10. t – Statistics for population correlation:

$$t = r \sqrt{\frac{n-2}{1-r^2}}$$

Where t = population correlation coefficient

r = sample correlation coefficient

n = sample size

$n-2$ = degree of freedom

11. Economic order quantity, critical probability and recorder point

$$Q = \sqrt{\frac{2DC_0}{C_h}}$$

$$P = \frac{DC_s / Q}{C_h + DC_s / Q}$$

$$R = D_d L + Z\sigma$$

Where Q = Economic order quantity

D = Annual demand

C_0 = Order cost per order

C_h = Holding cost per unit per year

Present value table

Present value of 1.00 unit of currency, that is $(1 + r)^{-n}$ where r = interest rate; n = number of periods until payment or receipt.

Periods (n)	Interest rates (r)									
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621
6	0.942	0.888	0.837	0.790	0.746	0.705	0.666	0.630	0.596	0.564
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239
16	0.853	0.728	0.623	0.534	0.458	0.394	0.339	0.292	0.252	0.218
17	0.844	0.714	0.605	0.513	0.436	0.371	0.317	0.270	0.231	0.198
18	0.836	0.700	0.587	0.494	0.416	0.350	0.296	0.250	0.212	0.180
19	0.828	0.686	0.570	0.475	0.396	0.331	0.277	0.232	0.194	0.164
20	0.820	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149

Periods (n)	Interest rates (r)									
	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	0.812	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694
3	0.731	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579
4	0.659	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482
5	0.593	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402
6	0.535	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335
7	0.482	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279
8	0.434	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233
9	0.391	0.361	0.333	0.308	0.284	0.263	0.243	0.225	0.209	0.194
10	0.352	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162
11	0.317	0.287	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135
12	0.286	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112
13	0.258	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093
14	0.232	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078
15	0.209	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.079	0.065
16	0.188	0.163	0.141	0.123	0.107	0.093	0.081	0.071	0.062	0.054
17	0.170	0.146	0.125	0.108	0.093	0.080	0.069	0.060	0.052	0.045
18	0.153	0.130	0.111	0.095	0.081	0.069	0.059	0.051	0.044	0.038
19	0.138	0.116	0.098	0.083	0.070	0.060	0.051	0.043	0.037	0.031
20	0.124	0.104	0.087	0.073	0.061	0.051	0.043	0.037	0.031	0.026

End of Question Paper