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Serial No.....

Institute of Certified Management Accountants of Sri Lanka

Technician Stage September 2009 Examination

Examination Date : 26th September 2009
Examination Time : 9.30 a.m.- 12.30 p.m.

Number of Pages : 07
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)

- (i) Two companies, A and B, have a contract to manufacture 420 window frames. Company A can make 20 frames per day, where as company B can make 4 frames the first day, 6 frames the second day, 8 frames the third day and so on.
- (a) Which company will finish making frames, first? **(06 Marks)**
- (b) After how many days will they both have the same number of frames manufactured? **(06 Marks)**
- (ii) If the world population is increasing at the rate of 2% per year, how long will it take to double? **(08 Marks)**
- (Total 20 Marks)**

Question No. 2 (20 Marks)

- (i) At what rate of simple interest will Rs.10,000/- become Rs.14,000/- over a period of 8 years? **(04 Marks)**
- (ii) How much interest accumulates if Rs.10,000/- is left in a bank for 20 years at 12% per annum compounded? **(08 Marks)**
- (iii) The book value of a machine after 7 years is Rs.4,198/-. If it is depreciated at a fixed rate of 22.5% per annum, what is its cost price? **(08 Marks)**
- (Total 20 Marks)**

Question No. 3 (20 Marks)

(i) A set of data from a sales department for the purpose of sales, is given below:

| Quality q demanded per week | Price p per unit (Rs.) |
|-------------------------------|--------------------------|
| 5000 | 500 |
| 4000 | 600 |
| 3000 | 700 |
| 2000 | 800 |
| 1000 | 900 |

| Quality q supplied per week | Price p per unit (Rs.) |
|-------------------------------|--------------------------|
| 1000 | 100 |
| 2000 | 200 |
| 3000 | 300 |
| 4000 | 400 |
| 5000 | 500 |

- (a) Assuming linearity, find the linear supply function. **(05 Marks)**
 (b) Assuming linearity, find the linear demand function. **(05 Marks)**
 (c) Find the equilibrium price and quantity. **(02 Marks)**

(ii) A company with manufacturing plants has labour-hour and wage requirements for manufacturing three types of boats, as given in the following two matrices:

| | | Labour – hours per boat | | |
|-----|-------------------|---------------------------|----------------------------|-----------------------------|
| | | Cutting Department (Hrs.) | Assembly Department (Hrs.) | Packaging Department (Hrs.) |
| M = | One person boat | 16.0 | 6.0 | 2.0 |
| | Two persons boat | 10.0 | 9.0 | 3.0 |
| | Four persons boat | 15.0 | 12.0 | 4.0 |

| | | Hourly Wages | |
|-----|----------------------|---------------|----------------|
| | | Plant I (Rs.) | Plant II (Rs.) |
| N = | Cutting Department | 80 | 90 |
| | Assembly Department | 100 | 120 |
| | Packaging Department | 50 | 60 |

- (a) Find the below costs for a one-person boat, manufactured at plan I; that is, find the product:

$$[16 \quad 6 \quad 2] \begin{bmatrix} 80 \\ 100 \\ 50 \end{bmatrix} \quad \text{(02 Marks)}$$

- (b) Find MN. **(04 Marks)**
 (c) Interpret MN. **(02 Marks)**

(Total 20 Marks)

Question No. 4 (20 Marks)

An electronic company records the number of computers sold each week, and the results are summarized in the accompanying stem- and – leaf plot.

| | | | | | | |
|---|--|---|---|---|---|---|
| 0 | | 3 | 5 | 5 | 8 | |
| 1 | | 0 | 1 | 1 | 3 | 9 |
| 2 | | 1 | 3 | 7 | 7 | 7 |
| 3 | | 2 | 2 | 3 | 5 | |

Find the following.

- (a) The mean. **(05 Marks)**
 - (b) The mode. **(01 Mark)**
 - (c) The median. **(03 Marks)**
 - (d) The variance. **(10 Marks)**
 - (e) The Standard Deviation. **(01 Mark)**
- (Total 20 Marks)**

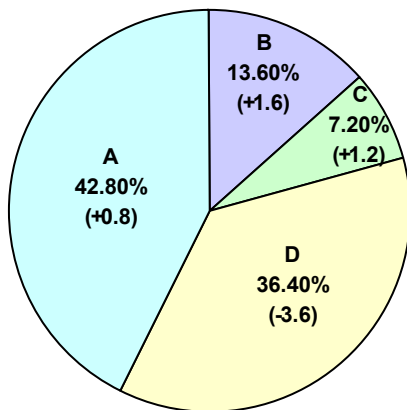
Question No. 5 (20 Marks)

- (i) On a weekend, six major luxury hotels in a capital city reported that the following numbers of rooms were occupied.

| Hotel | A | B | C | D | E | F |
|--------------------------|-----|-----|-----|-----|-----|-----|
| Number of rooms occupied | 400 | 804 | 540 | 632 | 996 | 628 |

- (a) Construct a relative frequency bar chart for the data? **(06 Marks)**
 - (b) Is it possible to determine which hotel had the greatest percentage of its rooms filled on that weekend? **(02 Marks)**
 - (c) What other information about the hotels would make the data more meaningful? **(02 Marks)**
- (ii) Although company B and company C have increased their market shares more than company A's share, in recent years, company A still dominates the fast-food market as shown in the following pie chart.

2008 Market Shares



The percentage point change in market shares since 2005 are given within brackets.

You are required to:

- (a) The market shares portrayed in the pie chart were based on 2008 sales. If company A's sales, were Rs.12 Billion. Find company B's, C's and D's sales. **(05 Marks)**
- (b) Construct a pie chart that displays the market shares for 2005 fast-food market. **(05 Marks)**
(Total 20 Marks)

Question No. 6 (20 Marks)

- (i) The telephone lines coming into an office are all occupied about 60% of the time.
- (a) If you are calling this office, what is the probability that you complete your call on the first try? Second try? **(02 Marks × 02 = 04 Marks)**
- (b) If you and a friend must complete separate calls to this office, what is the probability that it takes a total of three tries for the two of you? **(06 Marks)**
- (ii) The manager of a department store with three floors reports that the time a customer on the second floor must wait for an elevator has a uniform distribution ranging from 0 to 4 minutes.
- (a) What is the mean time a customer on the second floor waits for an elevator?**(05 Marks)**
- (b) If it takes the elevator 15 seconds to go from a floor, find the probability that a customer in a hurry can reach the floor in less than 1.5 minutes after pushing the second floor elevator button. **(05 Marks)**
(Total 20 Marks)

Question No. 7 (20 Marks)

The manufacturer of a pain reliever claims that their product brings pain relief to headache sufferers in less than 3.5 minutes on average. In order to be able to make this claim, they reported that for a random sample of 50 headache sufferers, the means time to relief was 3.3 minutes and the standard deviation was 66 seconds.

- (a) Does this data support the manufacture's claim? Test the claim using $\alpha = 0.05$ significance level. **(15 Marks)**
- (b) Report the p -value of the test. **(03 Marks)**
- (c) In general, do large p - values or small p - values support the manufacture's claim?**(02 Marks)**
(Total 20 Marks)

Question No. 8 (20 Marks)

A dietitian wishes to blend two types of food A and B, so that the vitamin content of the mixture is at least 10 units of vitamin R, 15 units of vitamin S and 18 units of vitamin T. The vitamin contents of A and B, in units of kilograms are shown in the following table.

| Food | Vitamins | | |
|------|----------|---|---|
| | R | S | T |
| A | 2 | 2 | 3 |
| B | 1 | 5 | 4 |

- (a) State constraints to formulate a linear programming problem. **(04 Marks)**
 - (b) Sketch the feasibility region. **(10 Marks)**
 - (c) Find the coordinates of the vertices of the feasibility region. **(03 Marks)**
 - (d) If A costs Rs.70 per Kg and B costs Rs.56 per Kg, find the minimum cost of the blended food. **(03 Marks)**
- (Total 20 Marks)**

Question No. 9 (20 Marks)

- (i) The annual usage of a component by company A is 3000 units per year. Company B is able to manufacture these components at the rate of 4000 per year. Component cost is Rs.100/- per unit, inventory carrying costs are Rs.40/- per year and fixed cost to place an order is Rs.600/-.

Find the following.

- (a) Economic order quantity. **(06 Marks)**
 - (b) Minimum total annual cost. **(04 Marks)**
- (ii) A project has the specifications shown in the following table.

| Activity | A | B | C | D | E | F | G | H |
|----------------------------|----|----|----|---|----|-----|-----|-----|
| Immediate Predecessors | - | - | A | B | A | D,E | C,F | D,E |
| Activity Duration in weeks | 10 | 13 | 15 | 8 | 10 | 8 | 20 | 9 |

- (a) Construct the project network. **(07 Marks)**
 - (b) Find the critical path. **(03 Marks)**
- (Total 20 Marks)**

List of Formulae

1. Economic order quantity (Q) and total annual cost (TC):

$$Q = \sqrt{\frac{2FD}{Cr \left(1 - \frac{D}{P}\right)}}$$

$$TC = F \left(\frac{D}{Q}\right) + Cr \left(\frac{Q}{2}\right) \left(1 - \frac{D}{P}\right),$$

Where F = Fixed cost to place an order (Rs. / order)

D = Demand rate (units / year)

C = Cost of a component (Rs. / unit)

P = Production rate (units / year)

r = Carrying cost rate (Rs. / units / year)

Q = Economic order quantity

2. Compound Interest:

$$A = P \left[1 + \left(\frac{r}{100}\right)\right]^n$$

Where P = Initial amount

n = number of years

r = annual interest rate

A = amount accumulated after n years.

3. Depreciation:

$$A = P (1 - r^n),$$

Where P = Present Value

r = annual interest rate

n = number of years

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