**CAP-III, Advanced Cost & Management Accounting, Dec 2013**
**Suggested Answer**

**Roll No…………….** **Maximum Marks - 100**

**Total No. of Questions - 7** **Total No. of Printed Pages - 6**

**Time Allowed - 3 Hours**

**Marks**

**Attempt all questions. Working notes should form part of the answer.**

1.

a) While applying for a job in a foreign toy manufacturing company, you are given the following case for your analysis and recommendation:

The company has produced two top-of-the-range electronic toys, named Tom and Jerry, at its factory for several years. On 28th December 2013, Jerry will be dropped from the product line since it is causing health hazard to very young children (to whom it was not designed) and a lot of public complaints are being received.

The company manufactures and sells 100,000 units of Tom annually and this level of production is not expected to change, even if the product Jerry is dropped. The factory is situated in a leased building; the lease expires on 31st December 2017. The annual rent is Rs. 150,000. The lease agreement provides for the tenant to sublet part or all of the premises. At the end of the lease, the company intends to close the factory, scrap the equipment and start a fresh line of products in video games in another location.

Jerry has been produced on two assembly lines equipments which occupy 30% of the factory space. The assembly lines equipments will have a book value of Rs. 27,000 and a remaining useful life of seven years at 31st December 2013, the end of the company's financial year.

The company uses an inexpensive microprocessor in each unit of Tom. The microprocessor is currently purchased under a contract requiring a minimum annual purchase of 10,000 units. This contract also expires on 31st December 2017. The contractor's scale of prices is as follows:

| Annual order of microprocessor (unit) | Price per unit (Rs.) |
|---|---|
| 10,000 – 14,999 | 4.00 |
| 15,000 – 39,999 | 3.90 |
| 40,000 – 69,999 | 3.60 |
| 70,000 – 199,999 | 3.30 |
| 200,000 – 500,000 | 2.70 |

The company is currently considering the alternatives for using the space previously used to make Jerry. Some of these alternatives may be used in combination and all can be put into operation by 1st January 2014. There are following four alternatives:

i) No action is taken. In such a situation the factory will be operated profitably as before and the manufacturing overhead is not expected to differ significantly from past years when Jerry was manufactured.
ii) The two assembly lines equipments which produced Jerry could be sold for Rs. 140,000. The purchaser will buy the same and he will pay all expenses of removal.
iii) The floor space used by Jerry could be sublet for an annual rent of Rs. 24,200. Under the terms of the lease, the equipment must be removed and leasehold improvements costing Rs. 76,000 must be implemented. All non-removable

leasehold improvements will revert to the lessor. Under this alternative, indirect costs are expected to increase by Rs. 7,000 each year.

iv) One or both of the Jerry assembly lines could be converted to manufacture the microprocessor used in Tom. Each line would cost Rs. 91,000 for conversion, which would last for ten years, and would be capable of producing up to a maximum of 74,000 units of the microprocessor each. Unit direct material and direct labour costs are Rs. 0.20 and Rs. 0.50 respectively for the production. Under this alternative, the annual manufacturing overhead is expected to increase from Rs. 1.10 million to Rs. 1.210 million if one line is converted and to Rs. 1.246 million if both lines are converted.

Required: **15**

Analyze the optimum utilization of the following options for the four years ending on 31st December 2017 with required calculations and put you recommend thereon. You should ignore taxation and should clearly mention the reason for taking each and every item in your calculation.

Option 1: Sell equipment, rent the space formerly occupied by Jerry, and continue to purchase units of microprocessor as required.

Option 2: Sell equipment, leave space free, and continue to purchase units of microprocessor as required.

Option 3: Use both assembly lines to produce microprocessor and purchase units as required.

Option 4: Use one assembly line to produce microprocessor and purchase additional units as required.

b) In the context of short-term decision making, what do you understand by cost indifference point? How does it differ from break-even point? **5**

**Answer** **a)** Analysis for utilization of spare capacity for years 2014–2017

Option 1:

| Particulars | Amount (Rs.) | Remarks |
|---|---|---|
| Cost to purchase microprocessors 100,000 units per year @ Rs. 3.30 for 4 years | 1,320,000 | Relevant cost, since it differs among alternatives. |
| Rental income for 4 years (24200×4) | (96,800) | Relevant because it differs among alternatives and arises in future. |
| Leasehold improvements | 76,000 | Arises only if space is opted for rent. |
| Indirect costs for 4 years (7000×4) | 28,000 | Increases if space is sub-let. |
| Sales price of equipment | (140,000) | Sales price is relevant, and not the cost. |
| Total costs | 1,187,200 | |

Option 2:

| Particulars | Amount (Rs.) | Remarks |
|---|---|---|
| Cost to purchase microprocessors 100,000 units per year @ Rs. 3.30 for 4 years | 1,320,000 | Relevant cost, since it differs among alternatives. |
| Sales price of equipment | (140,000) | Sales price is relevant, and not the cost. |
| Total costs | 1,180,000 | |

Option 3:

| Particulars | Amount (Rs.) | Remarks |
|---|---|---|
| Cost to purchase microprocessors 10,000 units per year @ Rs. 4.00 for 4 years (minimum contractual) | 160,000 | Relevant cost, since it differs among alternatives. |
| Cost to convert assembly lines (Rs. 91000×2) | 182,000 | Requires to be incurred for this option, and is avoidable if other option is selected. |
| Cost to produce microprocessor:<br>• Material: 90,000 units per year at Rs. 0.20 for 4 years<br>• Labour: 90,000 units per year @ Rs. 0.50 for 4 years | <br>72,000<br><br>180,000 | Requires to be incurred for this option, and is avoidable if other option is selected. Relevant cost for conversion of assemble line to manufacturing the microprocessor |
| Additional overhead costs Rs. (1.246 million-1.100 million)×4 | 584,000 | Incremental cost and relevant |
| Total costs | 1,178,000 | |

Option 4:

| Particulars | Amount (Rs.) | Remarks |
|---|---|---|
| Cost to purchase microprocessors 26 000 units per year at Rs. 3.90 for 4 years (100 000 – 74 000) | 405 600 | Relevant cost, since it differs among alternatives. |
| Cost to convert assembly lines | 91,000 | Requires to be incurred for this option, and is avoidable if other option is selected. It also differs among alternatives. |
| Cost to produce microprocessor:<br>• Material: 74,000 units per year @ Rs. 0.20 for 4 years<br>• Labour: 74 000 units per year @ Rs. 0.50 for 4 years | <br>59,200<br><br>148,000 | Requires to be incurred for this option, and is avoidable if other option is selected. It also differs among alternatives. Relevant cost for conversion of assemble line to manufacturing the microprocessor |
| Additional overhead costs Rs. (1.246 million-1.100 million)×4 | 440,000 | Incremental cost and relevant. |
| Total costs | 1,143,800 | |

Description and recommendation on analytical figures:
There is a difference of USD 43,400 over four years between the cheapest option (No. 4) and the most expensive (No. 1). The management of the company should go for the cost saving option No.4. It should also be considered that the product line must be dropped due to its unsuitability among the children, and management should opt for cost saving option.
Further, note that options 3 and 4 give management maximum flexibility by allowing the company to retain the production capability afforded by the former Jerry assembly lines.
Also, note that the estimated life of the converted plant is irrelevant. The only figure that matters is the cash spent in converting it.

**b)** A *cost indifference point* is the point where the total cost (fixed and variable) of the two alternatives under consideration is the same. Suppose a company has two methods available for producing goods. It may happen that one production method is suitable up to a certain point whereas the second method is beneficial beyond that point. The level of capacity where the choice shifts from one production method to another is called cost indifference point and at this point, total cost will be the same for both the alternatives.

The cost indifference point is found out by using the following formula:

Cost indifference point = $\frac{\text{Differential fixed cost}}{\text{Differential variable cost per unit}}$

Cost indifference point is therefore the point at which the cost lines under two alternatives intersect each other. On the other hand, under break-even point, total cost line and total revenue line for a particular alternative are equal (or intersect each other). Thus, analysis of cost indifference point compares the cost of two alternatives whereas break-even analysis compares total cost and total revenue of a single product.

2. A newly established pharmaceutical company of Nepal has recently developed a new drug by the name of ABCE, which is made using a continuous microbiological process. The procurement of material is the responsibility of the Process Manager of the company. Four material ingredients (A, B, C and E) are used in the processing of ABCE, all of which are obtainable from a variety of sources. The standard material requirement of 1 kg. of ABCE is as follows:

| | | | |
|---|---|---|---|
| A | 0.32 kg. | @ Rs. 105 per kg. | Rs. 33.60 |
| B | 0.28 kg. | @ Rs. 50 per kg. | Rs. 14.00 |
| C | 0.24 kg. | @ Rs. 185 per kg. | Rs. 44.40 |
| E | 0.46 kg | @ Rs. 70 per kg. | Rs. 32.20 |
| | 1.30 kg. | | Rs. 124.20 |

Process losses occur at an even rate throughout the processing operation and tend to rise depending on the impurities present in the ingredients. The effectiveness of ABCE depends on the quality of the ingredients being used and the maintenance of the ingredient mixture within the close limits of the standard as specified above.

At the start of Shrawan 2070, 318.6 kg. of 40% processed ABCE were held in the division. At the end of Shrawan of the same year, 426.712 kg. of 48% processed ABCE were held. During the month, 831 kg. of fully processed ABCE were transferred from the division to the stores.

The following materials were procured and input to the process during the month:

A 291.6 kg. at a cost of Rs. 30,006
B 242.6 kg. at a cost of Rs. 12,421
C 198.2 kg. at a cost of Rs. 37,262
E 392.0 kg. at a cost of Rs. 26,719

Required: **(12+3=15)**

a) Calculate materials total cost variance, materials price variance, materials usage variance, materials mixture variance and materials yield variance in regard to material input in Shrawan 2070, and

b) Present these variances in the form of a financial control report for presentation to the company's management. (You may assume that the opening and closing work-in-progress are subject to normal process losses only.)

**Answer**

**The equivalent weight of products in the WIP is**

Opening stock of 1.3 Kg after processing [100%] become 1 Kg i.e. 0.3 Kg is lost for entire production. Considering that only 40% is worked so far, only 40% of 0.3 Kg (or 1.2 Kg) is lost so far. Equivalent production for the Srawan for the opening WIP hence is 60% of 0.3Kg (i.e. 1.8 Kg).

Therefore equivalent units for work done on opening WIP = [318/(1+0.3*60%) ] 270

Similarly, equivalent units for work done on Closing WIP = [426.712 / (1+0.3*48%) ] 373

| **Equivalent Production for Srawan 2069** | **Kgs** | |
|---|---|---|
| Production transferred to store | 831 | |
| Add, Closing Stock | 373 | |
| **Total Production** | **1,204** | |
| Less, | | |
| Opening Stock | 270 | |
| **Total Production during the month [Output]** | **934** | |
| Total Input during the month [Input] | 1,214 | [934*1.3] |

# Only proportionate loss is considered. The process losses occur at even rate throughout the processing operation. The input of 1.30 kg. become 1.00 kg. output at the end of processing. It is thus evident that complete processing leads to a loss of 0.30 kg. This loss will be proportionate to the stage of completion. The opening stock was 60% complete and therefore 40% work will have to be done to complete it. The closing stock was 48% complete and therefore 52% will be considered for working out equivalent work done.

**Restructured Input**

| **Standard for Actual Production i.e. 934 KG** | | | **Revised Standard** | **Actual for Actual Production i.e. 934 KG** | | |
|---|---|---|---|---|---|---|
| **SQ** | **SP** | **Product** | **RSQ** | **AQ** | **AP** | **Product** |
| 298.88 | 105.00 | 31,382.40 | 276.78 | 291.60 | 102.90 | 30,006.00 |
| 261.52 | 50.00 | 13,076.00 | 242.18 | 242.60 | 51.20 | 12,421.00 |
| 224.16 | 185.00 | 41,469.60 | 207.58 | 198.20 | 188.00 | 37,262.00 |
| 429.64 | 70.00 | 30,074.80 | 397.86 | 392.00 | 68.16 | 26,719.00 |
| **1,214.20** | | **116,002.80** | **1,124.40** | **1,124.40** | | **106,408.00** |

1 Material Price Variance - (SP - AP)XAQ

| | | | |
|---|---|---|---|
| A | (105-102.9) X 291.6 = | 612.00 | F |
| B | (50-51.2) X 242.6 = | (291.00) | A |
| C | (185-188) X 198.2 | (595.00) | A |

| | | | |
|---|---|---|---|
| E | (70-68.16) X 392 | 721.00 | F |
| | | **447.00** | F |

2 Material Usage Variance - (SQ-AQ)XSP

| | | | |
|---|---|---|---|
| A | (298.88-291.6) X 105 | 764.40 | F |
| B | (261.52-242.6) X 50 | 946.00 | F |
| C | (224.16-198.2) X 185 | 4,802.60 | F |
| E | (429.64-392.0) X 70 | 2,634.80 | F |
| | | **9,147.80** | F |

3 Material Cost Variance - Material Price Variance + Material Usage Variance

| | | | |
|---|---|---|---|
| | (116,002.8-106,408.0) | **9,594.80** | F |

4 Material Mix Variance - (RSQ-AQ)*SP

| | | | |
|---|---|---|---|
| A | (276.78-291.6) X 105= | (1,556.58) | A |
| B | (242.18-242.6) X 50= | (21.08) | A |
| C | (207.58-188.0) X 185= | 1,735.58 | F |
| E | (397.86-392.0) X 70= | 410.52 | F |
| | | **568.45** | F |

4 Material Yield Variance - (SQ-RSQ)*SP

| | | | |
|---|---|---|---|
| A | (298.88- 276.78) X 105= | 2,320.98 | F |
| B | (261.52-242.18) X 50= | 967.08 | F |
| C | (224.16-207.58) X 185= | 3,067.02 | F |
| E | (429.64-397.86) X 70= | 2,224.28 | F |
| | | **8,579.35** | F |

**<u>Financial Control Report for Srawan 2069</u>**

| | | | |
|---|---|---|---|
| **Annual Material Cost** | | | **106,408.00** |
| Price Variance | | 447.00 | |
| **Usage** | | | |
| Mix | 568.45 | | |
| Yield | 8,579.35 | **9,147.80** | 9,594.80 |
| **Standard Material Cost** | | | **116,002.80** |

a) The relevant data and details in respect of a manufacturing company are provided below.

| | Products P | Q | R | Total |
|---|---|---|---|---|
| Production and sales (units) | 60,000 | 40,000 | 16,000 | |
| Raw materials usage (in units) | 10 | 10 | 22 | |
| Raw materials costs | Rs. 50 | Rs. 40 | Rs. 22 | Rs. 4,952,000 |
| Direct labour hours | 2.5 | 4 | 2 | 342,000 |
| Machine hours | 2.5 | 2 | 4 | 294,000 |
| Direct labour costs | Rs. 16 | 24 | 12 | |
| Number of production runs | 6 | 14 | 40 | 60 |
| Number of deliveries | 18 | 6 | 40 | 64 |
| Number of receipts | 60 | 140 | 880 | 1,080 |
| Number of production orders | 30 | 20 | 50 | 100 |

| Overhead | Rs. |
|---|---|
| Set-up | 60,000 |
| Machines | 1,520,000 |
| Receiving | 870,000 |
| Packing | 500,000 |
| Engineering | 746,000 |
| | Rs. 3,696,000 |

The company operates a just-in-time (JIT) inventory policy and receives each component once per production run.

You are required to compute the product cost: **(3+6=9)**

i) Based on direct labour-hour recovery rate of overheads, and

ii) Using Activity Based Costing.

b) ABC Company has two divisions, Freezer and Box. The Freezer division manufactures freezers for refrigerated containers. Some of the freezer units are sold directly by the Freezer division to outside customers. The others are passed to the Box division which incorporates the freezer units into each of its boxes for sale to outside customers. Both divisions have been set up as profit centers and have had a long history of rivalry about which is the more profitable; the question of transfer prices charged by the Freezer division has always been a sensitive issue. For some time now the market price of freezer units has been used because a number of competitors are active in the locality.

The following information is available to both divisions' management:

| Particulars | Rs. |
|---|---|
| Selling price of completed box | 33,750 |
| Selling price of freezer unit from Freezer division | 22,500 |
| Freezer division's costs per unit | 13,500 |
| Box division's costs per unit | 16,875 |

For his part, the manager of the Box division is concerned with the way his figures look, as below:

| Particulars | Rs. | Rs. |
|---|---|---|
| Selling price | | 33,750 |
| Cost: Bought-in component | 22,500 | |

| | | |
|---|---|---|
| Own division | 16,875 | 39,375 |
| Loss per container | | 5,625 |

Required: **6**

i) If there is no surplus capacity, should the Freezer division be required to transfer freezer units to the Box division? If so, is the market price (as currently used) the most appropriate one?

ii) Current space limitations restrict Freezer division from making more than 1,400 units per month, of which 1,100 units are sold to external customers. Should the balance be transferred to Box division? If so, at what price?

**Answer a) Product Cost based on Direct Labour Hour:**

*Products*

| | *P* | *Q* | *R* |
|---|---|---|---|
| Raw material cost | Rs. 50 | Rs. 40 | Rs. 22 |
| Direct labour costs | 16 | 24 | 12 |
| Overhead (see working note below) | 27 | 43 | 22 |
| Total: | 93 | 107 | 56 |

***Working Note:***

Direct labour hour rate = Total Overheads/Direct labour hours = Rs. 36,96,000/3,42,000 = Rs. 10.81.

| | *Direct Labour Hours* | *Rate/DLH* | *Total* |
|---|---|---|---|
| P | 2.5 | Rs. 10.81 | Rs. 27 |
| Q | 4.0 | 10.81 | 43 |
| R | 2.0 | 10.81 | 22 |

**(ii) Product Costs using Activity Based Costing:**

| *Cost of Activity* | *Base* | *Working* | *Unit Cost* |
|---|---|---|---|
| Set up cost | Set up cost / No. of production runs | 60,000 / 60 | Rs. 1,000 per set up |
| Receiving | Receiving cost / No. of Orders | 8,70,000 / 1,080 | Rs. 805.55 per order |
| Packing | Packing cost / No. of Orders Delivered | 5,00,000 / 64 | Rs. 7,812.50 per order |
| Engineering | Engineering cost / No. of product orders | 7,46,000 / 100 | Rs. 7,460 per order |
| Machine Hour Rate | Machine Overheads / Machine Hours | 15,20,000 / 2,94,000 | Rs. 5.17 per hour |

| Total Production | Unit Rate | Cost Driver | | | Total | | | Cost per unit | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | P | Q | R | P | Q | R | P 60,000 unit | Q 40,000 unit | R 16,000 unit |
| No of set ups | 1,000 | 6 | 14 | 40 | 6,000 | 14,000 | 40,000 | 0.10 | 0.35 | 2.50 |
| Machine Hour Rate | 5.17 | 2.5 | 2 | 4 | - | - | - | 12.93 | 10.34 | 20.68 |
| Receiving | 805.55 | 60 | 140 | 880 | 48,333 | 112,777 | 708,884 | 0.81 | 2.82 | 44.31 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Packing | 7,812.5 | 18 | 6 | 40 | 140,625 | 46,875 | 312,500 | 2.34 | 1.17 | 19.53 |
| Engineering | 7,460 | 30 | 20 | 50 | 223,800 | 149,200 | 373,000 | 3.73 | 3.73 | 23.31 |

**Statement showing product cost using Activity based Costing**

| *Products* | *P* | *Q* | *R* |
|---|---|---|---|
| Direct materials | Rs. 50.00 | Rs. 40.00 | Rs. 22.00 |
| Direct wages | 16.00 | 24.00 | 12.00 |
| Machine overhead | 12.93 | 10.34 | 20.68 |
| Set up | 0.10 | 0.35 | 2.50 |
| Receiving | 0.81 | 2.82 | 44.31 |
| Packing | 2.34 | 1.17 | 19.53 |
| Engineering | 3.73 | 3.73 | 23.31 |
| **Total:** | **85.91** | **82.41** | **144.33** |

**b)** **i.** Freezer division should certainly not be required to transfer freezer units to Box division. Freezer division is making more money on units sold to external customers than the company is making on the complete box as shown below by ABC Company's position:

| | Freezer (Rs.) | Box (Rs.) |
|---|---|---|
| Sales price | 22,500 | 33,750 |
| Costs (WN 1) | 13,500 | 30,375 |
| Profit | 9,000 | 3,375 |

WN 1:
The costs for the freezer is its own cost only, whereas the costs for box is derived by adding the freezer division's cost and its own cost; i.e. Rs. 13,500 + 16,875 = Rs. 30,375.

From above analysis, it is clear that if the company transfers freezer units from Freezer division to Box division, its profit per unit will decrease from Rs. 9,000 to Rs. 3,375. Therefore, the more freezer units sold outside the better.

Further, the market price-based transfer price would appear to be the best available transfer price because Rs. 22,500 is the cash that would be foregone if Freezer division redirected a unit away from the market towards Box division. It could reasonably expect to be recompensed fully for that income by Box division. If Box division could purchase the freezer unit at a lower price outside then it should be free to do so. But this is unlikely if Rs. 22,500 represents 'market price'.

ii) As soon as excess capacity can be detected in Freezer division the Rs. 22,500 market price becomes invalid for use as a transfer price for those units that cannot be disposed of externally. The divisional costs of Rs. 13,500 would seem to be the best price to settle at in the absence of additional information. In this way Freezer division breaks even on the surplus 300 units and Box division makes a profit of Rs. 3,375 as outlined in (i) above on each of the 300 surplus units. Hence, excess unit which cannot be sold at market i.e. 300 units must be transferred to Box division at a price of Rs. 13,500 i.e. unit cost of freezer.

3. A bank offers three products viz; Deposit, Loan and Credit Card. The bank has selected four activities for a detailed budgeting exercise, following Activity Based Costing methods. The bank wants to know the product-wise total cost per unit for the selected activities, so that prices may be fixed accordingly.
The following information is made available to formulate the budget:

| Activity | Cost driver | Present Cost | Estimation for the budget period |
|---|---|---|---|

| | | (Rs.) | |
|---|---|---|---|
| 1. ATM Services:<br>(a) Machine maintenance<br>(b) Rents<br>(c) Currency Replenishment Cost | No. of ATM transactions | <br>400,000<br>200,000<br>100,000 | <br>All fixed no change<br>All fixed no change<br>Expected to double during budget period |
| 2. Computer Processing | No. of Computer transactions | 500,000 | 50% fixed and no change is expected. The variable portion is expected to increase to three times the current level. |
| 3. Issuing Statements | No. of statements | 1,800,000 | At present, 3 lakhs statements are made. In the budget period, 5 lakhs statements are expected. For every increase of one lakh statement, one lakh rupees is the budgeted increase. |
| 4. Computer Inquiries | Telephone Minutes | 200,000 | Estimated to increase by 80% during the budget period. |

The activity drivers and their budgeted quantifies are given below:

| | Deposit (Rs.) | Loan (Rs.) | Credit Card (Rs.) |
|---|---|---|---|
| No. of ATM Transactions | 150,000 | - | 50,000 |
| No. of Computer Processing Transactions | 1,500,000 | 200,000 | 300,000 |
| No. of Statements to be issued | 350,000 | 50,000 | 100,000 |
| Telephone Minutes | 360,000 | 180,000 | 180,000 |

The bank budgets a volume of Rs. 58,600 deposit accounts, Rs. 13,000 loan accounts, and Rs. 14,000 Credit Card Accounts.

Required: **(4+4+2=10)**

a) Calculate the budgeted rate for each activity.

b) Prepare activity-wise budgeted cost statement.

c) Find the budgeted product cost per account for each product using a) and b) above.

**Answer a)** Budget Rate

| Activity | Activity Cost(Rs) Budgeted | Activity driver | No. of units of Activity Driver (Budgeted) | Budgeted Activity Rate (Rs) |
|---|---|---|---|---|
| 1. ATM services | 800,000 w.n.-1 | ATM | 200,000 | 4 |
| 2. Computer processing | 1,000,000 w.n.-2 | Computer transactions | 2,000,000 | 0.50 |
| 3. Issuing Statements | 2,000,000 w.n.-3 | No of Statements | 500,000 | 4.00 |
| 4. Customer Inquiries | 360,000 | Telephone Minutes | 720,000 | 0.50 |
| Budget Cost | 4,160,000 | | | |

Working Note:

| | | |
|---|---|---|
| 1) ATM | 400,000+200,000+2*100,000= | 800,000 |
| 2) Computer | 500,000 (Fixed=250,000) Variable 250,000 increase to 3 times = 750,000 | 1,000,000 |
| 3) Issuing Statements | 1,800,000+2*100,000= | 2,000,000 |
| 4) Customer Inquiries | 200,000+80%*200,000= | 360,000 |

**b)**

| Activity | Budgeted Activity Rate(Rs) | Deposits | Loans | Credit Cards |
|---|---|---|---|---|
| 1.ATM services | 4 | 600,000 | - | 200,000 |
| 2.Computer processing | 0.50 | 750,000 | 100,000 | 150,000 |
| 3.Issuing Statements | 4.00 | 1,400,000 | 200,000 | 400,000 |
| 4.Customer Inquiries | 0.50 | 180,000 | 90,000 | 90,000 |
| Budget Cost | | 2,930,000 | 390,000 | 840,000 |

**c)**

| Activity | Deposits | Loans | Credit Cards |
|---|---|---|---|
| Budget Cost | 2,930,000 | 390,000 | 840,000 |
| Units of product as estimated in the budget period | 58,600 | 13,000 | 14,000 |
| Budgeted cost per unit of the product | 50 | 30 | 60 |

4. Answer the following questions: **(4×2.5=10)**

   a) Interfering float in a network analysis
   b) Uses of Learning Curve Theory
   c) Inventoriable costs
   d) Reasons for failure of ERP implementation

**Answer a)** Utilization of the float of an activity sometimes affect the float times of the other activities in the network. The part of the total float which causes a reduction in the float of the successor activities is called interfering float.

The value of interfering float is found out as the difference between the latest finish time and the earliest starting time of the activity or zero, whichever is larger. It indicates the portion of activity float which cannot be consumed without adversely affecting the float of subsequent activity or activities.

**b)**

i) To calculate the marginal cost.
ii) To quote selling price for a contract.
iii) To prepare realistic budget.
iv) To prepare budgeted and actual costs and report cost variances.
v) To create an awareness between making profits and selling it at a loss-making price.

**c)** Inventoriable costs are the costs of a product that are considered as assets in the balance sheet when they are incurred. When the product is sold, these costs become cost of goods sold.

All manufacturing costs are inventoriable cost for manufacturing companies. Cost of direct materials, direct manufacturing labour costs and manufacturing overheads all form part of inventoriable costs.

On the other hand, in the case of merchandising-sector companies, inventoriable costs are the cost of purchasing the goods that are resold in the same form as these are purchased. These costs therefore comprise the cost of goods as well as any incoming freight, insurance and handling costs related to such goods

**d)** At its simplest level, ERP is a set of best practices for performing different duties in a company, including finance, HR, manufacturing and the warehouse. To get the most from the ERP system, you have to get people inside your company to adopt the work methods outlined in the system. If the people in the different departments that will use ERP don't agree that the work methods embedded in the system are better than the ones they currently use, they will resist using the ERP system or will want IT to change the system software to match the ways they currently do things. This is where ERP projects break down. Political fights break out over how—or even whether—the system software will be installed. IT gets bogged down in long, expensive customization efforts to modify the ERP system software to fit with powerful business barons' wishes. Customizations make the software more unstable and harder to maintain when it finally does come to life. Because ERP covers so much of what a business does, a failure in the software can bring a company to a halt, literally.

5.

a) A company manufactures two products A and B in two processes of production and assembly. The per unit profit contribution of A is Rs. 800 and that of B is Rs. 640. The company can sell, at the prevailing prices, either all the productions of A or all the productions of B, or any combination of both that it can manufacture. But, the manufacturing capacity of the company is constrained by the key resources of raw materials and labour of highly skilled nature required in both processes.

Both the products are manufactured with the use of the same raw material RM. Each unit of A requires 40 units of RM and each unit of B requires 20 units of RM. The only known supplier of RM can supply 600 units of the same each day.
Each unit of A and B requires 4 hours and 10 hours respectively of high skilled labour in production process. The company can obtain only 100 man-hours of such labour each day. Further, product A requires 2 man-hours in assembly process, whereas B requires 3 hours of such labour time. Only 38 man-hours of assembly labour is available each day.
Required: **(3+7=10)**

i) Formulate a linear programming model using the above information.
ii) Determine the quantity of A and B to be manufactured each day to maximize the total profit contribution using revised simplex method.

b) A Nepalese company manufactures popular brand of fast moving consumer goods (FMCG) in its two factories located at Bhainsepati and Nawalparasi. The existing factories are working to near full capacity of 12,000 and 14,000 tonnes per annum and it is not possible to increase the capacities of these factories. The products are transported to the four distribution centers $D_1$, $D_2$, $D_3$ and $D_4$. The demands in the distribution centers exceed current supply and are proportionately adjusted to current production capacity.

The demand for the products of the company is expected to rise continuously over the coming years. The company will need additional capacity of 12,000 tonnes to meet the full future demands. Two locations, Hetaunda and Janakpur have been identified to be feasible for the establishment of factories. Due to imminent fund limitations at present, the capacity of new factories has to be limited to 6,000 tonnes per annum and only one factory can be established for the time being either at Hetaunda or Janakpur. Demand for the company's products will still be marginally above production capacity. Proportionately adjusted transportation costs in monetary unit (MU) per unit are shown below.

| | $D_1$ | $D_2$ | $D_3$ | $D_4$ |
|---|---|---|---|---|
| Bhainsepati | 80 | 120 | 100 | 140 |
| Nawalparasi | 110 | 60 | 110 | 100 |
| Hetaunda | 140 | 110 | 150 | 70 |
| Janakpur | 100 | 130 | 80 | 140 |
| Demand | 9,000 | 8,000 | 10,400 | 4,600 |

The feasibility study has shown that the factory site at Hetaunda and Janakpur will incur an annual fixed cost of Rs. 5,600,000 MU and Rs. 6,000,000 MU respectively.

Required: **10**
Recommend the location for the establishment of new factory based on cost.

**Answer a)** Formulation of LP Model
Let $X_1$ units of A and $X_2$ units of B can be manufactured.
Objective function:
The per unit profit contribution from A is Rs. 800 and that of B is Rs. 640. The objective function is to maximize the total profit contribution from the products A and B. Therefore,
Max. $Z = 800X_1 + 640X_2$

Raw material constraints:
Each unit of A requires 40 units of RM and each unit of B requires 20 units of RM. The total quantity available is only 600 units each day. Therefore,
$40X_1 + 20X_2 \leq 600$

Production process time constraints:
Each unit of A and B requires 4 hours and 10 hours respectively of high skilled labour in production process. The company can obtain only 100 man-hours of such labour each day. Therefore,
$4X_1 + 10X_2 \leq 100$

Assembly process time constraints:
A requires 2 man-hours in assembly process, whereas B requires 3 hours of such labour time. Only 38 man-hours of assembly labour is available each day. Therefore,
$2X_1 + 3X_2 \leq 38$

Non-negative constraints:
$X_1, X_2 \geq 0$

Now, LP Model is:
Max. $Z = 800X_1 + 640X_2$
Subject to
$40X_1 + 20X_2 \leq 600$
$4X_1 + 10X_2 \leq 100$
$2X_1 + 3X_2 \leq 38$, and
$X_1, X_2 \geq 0$

ii) Determining the quantity of A and B to be manufactured each day to maximize the total profit contribution using revised simplex method:
Introducing slack variables $S_1$, $S_2$ and $S_3$ for $\leq$ situations and re-writing the problem:
Max. $Z = 800X_1 + 640X_2 + 0S_1 + 0S_2 + 0S_3$
Subject to
$40X_1 + 20X_2 + S_1 + 0S_2 + 0S_3 = 600$
$4X_1 + 10X_2 + 0S_1 + S_2 + 0S_3 = 100$
$2X_1 + 3X_2 + 0S_1 + 0S_2 + S_3 = 38$
Where,
$X_1, X_2, S_1, S_2, S_3 \geq 0$

Converting into standard LPP:

Row 0: $Z - 800X_1 - 640X_2 - 0S_1 - 0S_2 - 0S_3 = 0$
Row 1: $0Z + 40X_1 + 20X_2 + S_1 + 0S_2 + 0S_3 = 600$
Row 2: $0Z + 4X_1 + 10X_2 + 0S_1 + S_2 + 0S_3 = 100$
Row 3: $0Z + 2X_1 + 3X_2 + 0S_1 + 0S_2 + S_3 = 38$
Simplex Table I:

| Table I | Z | $X_1$ | $X_2$ | $S_1$ | $S_2$ | $S_3$ | Constant | Ratio |
|---|---|---|---|---|---|---|---|---|
| R0 | 1 | -800 | -640 | 0 | 0 | 0 | 0 | - |
| R1 | 0 | 40 | 20 | 1 | 0 | 0 | 600 | 600/40= 15 |
| R2 | 0 | 4 | 10 | 0 | 1 | 0 | 100 | 100/4= 25 |
| R3 | 0 | 2 | 3 | 0 | 0 | 1 | 38 | 38/2= 19 |

Key column is $X_1$ with highest negative value (-800) in R0.
Ratio for each row is derived by dividing the constant of each row with the value of key column, except for R0.
Key row is R1 with minimum ratio of 15.
Key element is 40; i.e. the value at the intersection of key column and key row.

Replacing value for key row (R1) is to be calculated by dividing the value of key row for Table I by key element:
New R1: 0/40, 40/40, 20/40, 1/40, 0/40, 0/40, 600/40
: 0, 1, 1/2, 1/40, 0, 0, 15

Replacing value for other remaining row is calculated using the following formula:
Replacing value = Element of old row – (intersecting element of old row with key column x corresponding element of replacing row)
Now,
Replacing value for R0

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Old R0 | 1 | -800 | -640 | 0 | 0 | 0 | 0 |
| Intersecting element | -800 | -800 | -800 | -800 | -800 | -800 | -800 |
| Element of replacing row | 0 | 1 | 1/2 | 1/40 | 0 | 0 | 15 |
| New R0 | 1 | 0 | -240 | 20 | 0 | 0 | 12000 |

Replacing value for R2

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Old R2 | 0 | 4 | 10 | 0 | 1 | 0 | 100 |
| Intersecting element | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Element of replacing row | 0 | 1 | 1/2 | 1/40 | 0 | 0 | 15 |
| New R2 | 0 | 0 | 8 | -1/10 | 1 | 0 | 40 |

Replacing value for R3

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Old R3 | 0 | 2 | 3 | 0 | 0 | 1 | 38 |
| Intersecting element | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Element of replacing row | 0 | 1 | 1/2 | 1/40 | 0 | 0 | 15 |
| New R3 | 0 | 0 | 2 | -1/20 | 0 | 1 | 8 |

Simplex Table II:

| Table II | Z | $X_1$ | $X_2$ | $S_1$ | $S_2$ | $S_3$ | Constant | Ratio |
|---|---|---|---|---|---|---|---|---|
| R0 | 1 | 0 | -240 | 20 | 0 | 0 | 12000 | - |
| R1 | 0 | 1 | 1/2 | 1/40 | 0 | 0 | 15 | 15x2/1= 30 |
| R2 | 0 | 0 | 8 | -1/10 | 1 | 0 | 40 | 40/8= 5 |
| R3 | 0 | 0 | 2 | -1/20 | 0 | 1 | 8 | 8/2= 4 |

Key column is $X_2$ with highest negative value (-240) in R0.
Key row is R3 with minimum ratio of 4.
Key element is 2; i.e. the value at the intersection of key column and key row.

Replacing value for key row (R3):
New R3: 0/2, 0/2, 2/2, -1/20x2, 0/2, 1/2, 8/2
: 0, 0, 1, -1/40, 0, 1/2, 4
Now,

Replacing value for R0

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Old R0 | 1 | 0 | -240 | 20 | 0 | 0 | 12000 |
| Intersecting element | -240 | -240 | -240 | -240 | -240 | -240 | -240 |
| Element of replacing row | 0 | 0 | 1 | -1/40 | 0 | 1/2 | 4 |
| New R0 | 1 | 0 | 0 | 14 | 0 | 120 | 12960 |

Replacing value for R1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Old R1 | 0 | 1 | 1/2 | 1/40 | 0 | 0 | 15 |
| Intersecting element | 1/2 | ½ | 1/2 | ½ | 1/2 | 1/2 | ½ |
| Element of replacing row | 0 | 0 | 1 | -1/40 | 0 | 1/2 | 4 |
| New R1 | 0 | 1 | 0 | 3/80 | 0 | -1/4 | 13 |

Replacing value for R2

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Old R2 | 0 | 0 | 8 | -1/10 | 1 | 0 | 40 |
| Intersecting element | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Element of replacing row | 0 | 0 | 1 | -1/40 | 0 | 1/2 | 4 |
| New R2 | 0 | 0 | 0 | 1/10 | 1 | -4 | 8 |

Simplex Table III:

| Table III | Z | $X_1$ | $X_2$ | $S_1$ | $S_2$ | $S_3$ | Constant |
|---|---|---|---|---|---|---|---|
| R0 | 1 | 0 | 0 | 14 | 0 | 120 | 12960 |
| R1 | 0 | 1 | 0 | 3/80 | 0 | -1/4 | 13 |
| R2 | 0 | 0 | 0 | 1/10 | 1 | -4 | 8 |
| R3 | 0 | 0 | 1 | -1/40 | 0 | ½ | 4 |

Since all the values of R0 is, now, ≥ 0, the optimal solution is reached.

Basic solution:

$$\begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} \begin{vmatrix} Z \\ X_1 \\ S_2 \\ X_2 \end{vmatrix} = \begin{vmatrix} 12960 \\ 13 \\ 8 \\ 4 \end{vmatrix}$$

Therefore, required quantity, to maximize total profit contribution, of A is 13 units and B is 4 units. It will give a total profit contribution of Rs. 12,960.

**b) Table showing Supply from Bhainsepati, Nawalparasi and Hetaunda**

| Factory | Destination | | | | Supply | Difference | | |
|---|---|---|---|---|---|---|---|---|
| | $D_1$ | $D_2$ | $D_3$ | $D_4$ | | | | |
| Bhainsepati (B) | 9,000 / 80 | 120 | 3,000 / 100 | 140 | 12,000 | 20 | 20 | 20 |
| Nawalparasi (N) | 110 | 8,000 / 60 | 6,000 / 110 | 100 | 14,000 | 40 | 10 | 10 |
| Hetaunda (H) | 140 | 110 | 1,400 / 150 | 4,600 / 70 | 6,000 | 40 | 40√ | 30 |
| Demand | 9,000 | 8,000 | 10,400 | 4,600 | 32,000 / 32,000 | | | |
| Difference 1 | 30 | 50√ | 10 | 30 | | | | |
| Difference 2 | 30 | × | 10 | × | | | | |

| Difference 3 | 30√ | × | 10 | × | | | | |
|---|---|---|---|---|---|---|---|---|

**Table showing Supply from Bhainsepati, Nawalparasi and Janakpur**

| Factory | Destination | | | | Supply | Difference | | | |
|---|---|---|---|---|---|---|---|---|---|
| | $D_1$ | $D_2$ | $D_3$ | $D_4$ | | | | | |
| Bhainsepati (B) | 9,000 / 80 | 120 | 3,000 / 100 | 140 | 12,000 | 20 | 20 | 20 | 20 |
| Nawalparasi (N) | 110 | 8,000 / 60 | 1,400 / 110 | 4,600 / 100 | 14,000 | 40 | 10 | 10 | 10 |
| Janakpur (J) | 100 | 130 | 6,000 / 80 | 140 | 6,000 | 50 | 20 | 30√ | × |
| Demand | 9,000 | 8,000 | 10,400 | 4,600 | 32,000 / 32,000 | | | | |
| Difference 1 | 20 | 60√ | 20 | 40 | | | | | |
| Difference 2 | 20 | × | 10 | 40√ | | | | | |
| Difference 3 | 20 | × | 10 | × | | | | | |
| Difference 4 | 20√ | × | 10 | × | | | | | |

**Optimal Transportation Plans and Costs**

Based on BNH

| *From* | *To* | *Qty.* | *Cost MU'000* |
|---|---|---|---|
| B | $D_1$ | 9,000 | 720 |
| | $D_3$ | 3,000 | 300 |
| N | $D_2$ | 8,000 | 480 |
| | $D_3$ | 6,000 | 660 |
| H | $D_3$ | 1,400 | 210 |
| | $D_4$ | 4,600 | 322 |
| | | | 2,692 |

Based on BNJ

| *From* | *To* | *Qty.* | *Cost MU'000* |
|---|---|---|---|
| B | $D_1$ | 9,000 | 720 |
| | $D_3$ | 3,000 | 300 |
| N | $D_2$ | 8,000 | 480 |
| | $D_3$ | 1,400 | 154 |
| | $D_4$ | 4,600 | 460 |
| J | $D_3$ | 6,000 | 480 |
| | | | 2,594 |

**Statement showing total cost of setting up of New Plant**

| | At Hetaunda | At Janakpur |
|---|---|---|
| Transportation cost | 2,692 | 2,594 |
| Fixed cost | 5,600 | 6,000 |
| | 8,292 | 8,594 |

From the view point of total cost (transportation and fixed cost), setting up of new factory at Hetaunda would be 392,000 MU lesser than establishing similar factory at Janakpur. It is therefore recommended that the factory should be set up at Hetaunda.

6. A travel agency has to deal with a number of clients. The time taken by the officer of the travel agency to deal with the clients and the arrival pattern of clients follow the distribution given below:

   Time to deal with the clients:

| Minutes | 2 | 4 | 6 | 10 | 14 | 20 | 30 |
|---|---|---|---|---|---|---|---|
| Probability | 0.05 | 0.10 | 0.15 | 0.30 | 0.25 | 0.10 | 0.05 |

Time elapsing between arrivals of clients:

| Minutes | 1 | 8 | 15 | 25 |
|---|---|---|---|---|
| Probability | 0.20 | 0.40 | 0.30 | 0.10 |

Take the starting time as 10 AM:

Line1: 02 48 43 75 89 36 96 47 36 61 45 98
Line2: 60 73 61 35 28 16 80 46 60 11 15 10

You are required to simulate the arrival and servings of 12 clients by taking the random numbers of line 1 for arrival pattern and line 2 for serving pattern and indicate which of the clients will wait for how many minutes. **10**

**Answer**

Time to deal into clients serving pattern:

| Time(Mts) | Probability | Cumulative Probability | Random Nos. Allocated |
|---|---|---|---|
| 2 | 0.05 | 0.05 | 00-04 |
| 4 | 0.10 | 0.15 | 05-14 |
| 6 | 0.15 | 0.30 | 15-29 |
| 10 | 0.30 | 0.60 | 30-59 |
| 14 | 0.25 | 0.85 | 60-84 |
| 20 | 0.10 | 0.95 | 85-94 |
| 30 | 0.05 | 1.00 | 95-99 |

Time between arrivals:

| Time(Mts) | Probability | Cumulative Probability | Random Nos. Allocated |
|---|---|---|---|
| 1 | 0.20 | 0.20 | 00-19 |
| 8 | 0.40 | 0.60 | 20-59 |
| 15 | 0.30 | 0.90 | 60-89 |
| 25 | 0.10 | 1.00 | 90-99 |

**Simulation:**

| Client No | Random Numbers | | Time Between arrivals | Arrival time | In | Serving time | Out | Time client waiting (mts) | Time office idle (mts) |
|---|---|---|---|---|---|---|---|---|---|
| | Arrival | Service | | | | | | | |
| 1 | 2 | 60 | 1 | 10.01 | 10.01 | 14 | 10.15 | - | - |
| 2 | 48 | 73 | 8 | 10.09 | 10.15 | 14 | 10.29 | 6 | |
| 3 | 43 | 61 | 8 | 10.17 | 10.29 | 14 | 10.43 | 12 | |
| 4 | 75 | 35 | 15 | 10.32 | 10.43 | 10 | 10.53 | 11 | |
| 5 | 89 | 28 | 15 | 10.47 | 10.53 | 6 | 10.59 | 6 | |
| 6 | 36 | 16 | 8 | 10.55 | 10.59 | 1 | 11.00 | 4 | |
| 7 | 96 | 80 | 25 | 11.20 | 11.20 | 14 | 11.34 | - | 20 |
| 8 | 47 | 46 | 8 | 11.28 | 11.34 | 10 | 11.44 | 6 | |
| 9 | 36 | 60 | 8 | 11.36 | 11.44 | 14 | 11.58 | 8 | |
| 10 | 61 | 11 | 15 | 11.51 | 11.58 | 4 | 12.02 | 7 | |
| 11 | 45 | 15 | 8 | 11.59 | 12.02 | 6 | 12.08 | 3 | |
| 12 | 98 | 10 | 25 | 12.24 | 12.24 | 4 | 12.28 | - | 16 |