FINAL EXAMINATION
GROUP - III
(SYLLABUS 2016)

SUGGESTED ANSWERS TO QUESTIONS
JUNE - 2018

Paper-15 : STRATEGIC COST MANAGEMENT – DECISION MAKING

Time Allowed : 3 Hours **Full Marks : 100**

The figures in the margin on the right side indicate full marks.

Section – A (20 Marks)

1. Choose the most appropriate answer to the following questions giving justification: 2x10=20

(i) A Company requires ₹ 85,00,000 in sales to meet its target net profit. Its contribution margin is 30% and the fixed costs are ₹ 15,00,000. What is the target net profit?
(a) ₹ 10,50,000
(b) ₹ 19,50,000
(c) ₹ 25,50,000
(d) ₹ 35,00,000

(ii) In a factory where standard costing system is followed, the production department consumed 1100 kgs of a material @ ₹ 8 per kg for product X resulting in material price variance of ₹ 2200 (Fav) and material usage variance of ₹ 1000 (Adv). What is the standard material cost of actual production of product X?
(a) 11,000
(b) 20,000
(c) 14,000
(d) 10,000

(iii) The following information relate to ABC

Activity level	60%	80%
Variable costs (₹)	12,000	16,000
Fixed costs (₹)	20,000	22,000

The differential cost for 20% capacity is
(a) ₹ 4,000
(b) ₹ 2,000
(c) ₹ 6,000
(d) ₹ 5,000

(iv) By making and selling 9,000 units of a product, a company makes a profit of ₹ 10,000, whereas in the case of 7,000 units, it would lose ₹ 10,000 instead. The number of units to break-even is
(a) 7,500 units
(b) 8,000 units
(c) 7,750 units
(d) 8,200 units

(v) 1200 units of microchips are required to be sold to earn a profit of ₹ 1,06,000 in a monopoly market. The fixed cost for the period is ₹ 74,000. The contribution in the monopoly market is as high as 3/4th of its variable cost. Determine the target selling price per unit.

(a) 450
(b) 325
(c) 400
(d) 350

(vi) An operation has a 90% learning curve and the first unit produced took 28 minutes. The labour cost is ₹ 20 per hour. How much should the second unit cost?
(a) ₹ 9.80
(b) ₹ 7.60
(c) ₹ 8.40
(d) ₹ 6.60

(vii) If project A has a net present value (NPV) of ₹ 30,00,000 and project B has an NPV of ₹ 50,00,000, what is the opportunity cost if project B is selected?
(a) ₹ 23,00,000
(b) ₹ 30,00,000
(c) ₹ 20,00,000
(d) ₹ 50,00,000

(viii) A company operates an activity based costing (ABC) system to attribute its overhead costs to cost objects. In its budget for the year-ending 31st August, 2018. The company expected to place a total of 2000 purchase orders at a total cost of ₹ 1,00,000. This activity and its related costs were budgeted to occur at a constant rate throughout the budget year which is divided into 13 four week periods.

During the four week period ended 30th June 2017, a total of 200 purchase orders were placed at a cost of ₹ 9,000. The over recovery of these costs for the four week period was
(a) ₹ 2,000
(b) ₹ 3,000
(c) ₹ 1,500
(d) ₹ 1,000

(ix) Empire Hotel has a capacity of 100 single rooms and 20 double rooms. Average occupancy is 70% for 365 days of the year. The rent for a double room is kept at 130% of a single room. The total room occupancy days in a year in terms of single room is
(a) 32193
(b) 30660
(c) 31660
(d) 30993

(x) Which of the following is correct in the context of network analysis?
(a) There can be one or more activities without a predecessor in a network.
(b) Where two activities have the same start and end events, the end event of one activity is numbered differently and then connected by a dummy to the original start event.
(c) When crashing is carried out, the non-critical paths have to remain non critical.
(d) If the critical path is longer than the other paths, the project may be completed by using a path having a shorter duration.

Answer:

1. (i) (a)
Explanation: ₹ 10,50,000
= (85,00,000 × 30%) – 15,00,000 = 10,50,000
Or
Sales × Contribution margin ratio or P.V. Ratio – Fixed Cost

(ii) (d)
Explanation: Actual Cost + Favourable Cost Variance = Standard Cost
1100 × 8 + 2200 – 1000 = 8800 + 1200 = 10,000

(iii) (c)

Explanation: Differential Costs = Differences in Fixed and Variable Cost = 4000 + 2,000 = 6,000.

(iv) (b)

Explanation:

Contribution for 2000 units = 20,000 (difference in profits for two output levels)
Hence, contribution per unit = 10.
Substituting in equation 1,00,000 = F + 10,000. Or F = 80,000.
BEP = 80000 / 10 = 8000.

(v) (d)

Explanation: Contribution = 1,06,000 + 74,000 = 1,80,000
Contribution/Unit = 180000/1200 = 150
Variable cost/unit = 150 ÷ ¾ = ` 200
Selling price = 350

(vi) (b)

Explanation:

1st unit = 28 min.
Average time p.u. for 2 units = 0.9 × 28 = 25.2
Total time for 2 units = 25.2 × 2 = 50.4
Time for second unit = 50.4 – 28 = 22.4 minutes
Cost for second unit = 22.4 × 20 ₹ /hr./60 minutes = 7.47
Since, (b) is close to 7.47, b is acceptable. Otherwise, none of the given data.

(vii) (b)

Explanation:

Opportunity cost represents the next best alternative foregone.
If B is chosen, only A is being foregone and hence the NPV of 30,00,000 is the present value of the opportunity lost.

(viii) (d)

Explanation:

For 2,000 purchase orders, cost budgeted is 1 lac. For 200, corresponding amount would be 10,000. But actual = 9,000. Hence over recovered is 10,000 – 9000 = 1000.

Or

Cost driver rate for order = 1,00,000 / 2,000 = 50 per order.
Cost recovered = 50 × 200 = 10,000.
Actual = 9,000
Over recovery = 1000

(ix) (a)

Explanation:

1 double room = 1.3 single in terms of revenue.
Capacity = 100 + 1.3 × 20 = 100 + 26 = 126 equivalent single rooms.
Total Room Occupancy p.a. = 126 × 365 × 70% = 32193 days.
Note: This can be arrived at by other ways also, taking for example 70% of only single rooms and then double rooms, etc.

(x) (a)

Explanation:

More than 1 activity can begin at the first node, say 1 – 2, 1 – 3, 1 – 4, etc. Each of these will have no predecessor.

Section – B

Answer any five questions.
Each Question carries 16 Marks.

16×5=80

2. (a) Relevant data relating to Trident Industries Limited are:

	Products			
	P	**Q**	**R**	**Total**
Production and Sales (Units)	**60,000**	**40,000**	**16,000**	
Raw Material Usage (in Units)	**10**	**10**	**22**	
Raw Material Costs (₹)	**50**	**40**	**22**	**24,76,000**
Direct Labour Hours	**2.5**	**4**	**2**	**3,42,000**
Machine Hours	**2.5**	**2**	**4**	**2,94,000**
Direct Labour Costs (₹)	**16**	**24**	**12**	
No. of Production Runs	**6**	**14**	**40**	**60**
No. of Deliveries	**18**	**6**	**40**	**64**
No. of Receipts	**60**	**140**	**880**	**1080**
No. of Production Orders	**30**	**20**	**50**	**100**

Overheads:	**₹**
Set-up	**60,000**
Machines	**15,20,000**
Receiving	**8,70,000**
Packing	**5,00,000**
Engineering	**7,46,000**

The Company operates a JIT inventory policy and receives each component once per production run.

Required:

(a) (i) Compute the product cost based on direct labour hour recovery rate of overheads.

(ii) Compute the product cost using Activity Based Costing. 4+8=12

(b) What is Target Cost? How would you determine it? 2+2=4

Answer:

2. (a) (i) Computation of overhead rate based on direct labour hour hours:

P	60,000	2.5	150000
Q	40,000	4	160000
R	16,000	2	32000
Total			342000

Total Overheads = 60,000 + 15,20,000 + 8,70,000 + 5,00,000 + 7,46,000 = 36,96,000

Overhead rate per direct labour hour = 36,96,000/3,42,000 = 10.807 = 10.81

Product Cost based on direct labour recovery rate:

	P	Q	R
Raw Material	50	40	22
Direct Labour	16	24	12
Overheads @ ₹ 10.81 per hour			
2.5 × 10.81	27.03		
4 × 10.81		43.24	
2 × 10.81			21.62

Total Cost	93.03	107.24	55.62

(ii) Cost Driver Rates:

Nature of Overhead	Overhead cost (₹)	Total Quantity of activity Driver	Activity Driver	Cost Driver Rate ₹/ unit of Cost driver
Set-up	60,000	60	Production Runs	1000
Machines	15,20,000	294000	Machine Hours	5.17
Receiving	8,70,000	1080	No. of Receipts	805.56
Packing	5,00,000	64	No. of Deliveries	7812.5
Engineering	7,46,000	100	No. of Production Orders	7460
Total				

Overhead allocation to products based on Activity Based Costing: (Total Value for Production units Basis)

Based on the whole production figures,

	P	Q	R
Production units	60,000	40,000	16,000
Raw Material	30,00,000	16,00,000	3,52,000
Direct Labour	9,60,000	9,60,000	1,92,000
Overheads Set-up @ ₹ 1000 per hour production run			
1000x6	6000		
1000x14		14,000	
1000x40			40,000
Machines @ ₹ 5.17 per machine hour			
2.5x60,000x5.17	7,75,500		
2x40,000x5.17		4,13,600	
4x16,000x5.17			3,30,880
Receiving @ 805.56 per receipt			
60x805.56	48,333.60		
140x805.56		1,12,778.40	
880x805.56			7,08,892.80
Packing @ 7812.5 per delivery			
18x7812.5	1,40,625		
6x7812.5		46,875	
40x7812.5			3,12,500
Engineering @ 7460 per production order			
30 x 7460	2,23,800		
20 x 7460		1,49,200	
50x7460			3,73,000
Total Overhead Cost	11,94,258.60	7,36,453.40	17,65,272.80
Total Cost	51,54,258.60	32,96,453.40	23,09,272.80

(b) Target Cost is the cost at which a proposed product with specified functionality and quality must be produced to generate a desired level of profitability at its anticipated selling price.

Target cost is Target selling price less the required profit margin

The target selling price is the price that is dictated by competition in case there are comparable products, or the perceived value that a customer will pay for the product in case there is no competition.

The desired profit level is fixed by the seller. The difference between the selling price and the profit margin represents the target cost to be achieved by design or cost reduction or by economies of scale or by other means.

How to determine target cost:
The market requirement is identified regarding design, utility, need for the product.
Target selling price is determined based on customer expectation and sales forecast.
Target production volume is set based on price volume relationship
Target profit margin is established based on the company's long term profit objectives, projected volumes, course of action, etc.
The target cost or allowable cost is determined as the target selling price minus the target profit margin.

3. An Engineering Co. manufactures a single product whose standard cost structure is as follows:

Direct materials: 24 kg at ₹ 30 per kg	**72.00**
Direct Labour : 6 hours at ₹ 4 per hour	**24.00**
Factory Overheads : 6 hours at ₹ 0.75 per hour	**4.50**
Total	**100.50**

The factory overheads are based on the following flexible budget:

Capacity	**80%**	**90%**	**100%**	**100%**
Production (units)	**6,000**	**6,750**	**7,500**	**8,250**
Overheads (₹)	**29,250**	**3,150**	**33,750**	**36,000**

Actual data for the month of January, 2018:

Budgeted production	**7,500 units**
Materials used	**19,240 kg at ₹ 31 per kg**
Direct labour	**46,830 hours at ₹ 4.20 per hour**
Actual factory overheads	**₹ 36,340**
Production completed	**7,620 units**

Details of Work-in-Progress:
Opening : 120 units, materials fully supplied, 50% converted.
Closing : 100 units, materials fully supplied, 50% converted.

Required:
(i) Effective or Equivalent Production for each element of cost.
(ii) Calculate:
(a) Material variances (cost, price and usage)
(b) Labour variances (cost, rate of pay and efficiency)
(c) Overhead variances (expenditure and volume variance, efficiency and capacity variance) **4+3+6=13**

Answer:

3. (i) Statement of Equivalent Production

	Units	Material		Labour and Overheads	
		%	Units	%	Units
Opening Work-in-Progress	120	---	---	50	60
Completely processes during the month	7,500	100	7,500	100	7,500
Closing Work-in-Progress	100	100	100	50	50
	7,720		7,600		7,610

Some required data (computed)
Material:
Standard Quantity: 7,600 @ 2.40 kg = 18,240 kg
Standard Value : 18,240 kg @ ₹ 30 = ₹ 5,47,200

Labour:
Standard Hours : 7,610 @ 6 hours = 45,660 hours
Standard Wages : 45,660 @ ₹ 4 per hour = ₹ 1,82,640

$$\text{Standard Production} = \frac{\text{Actual Hours}}{\text{Standard Hours per Unit}} = \frac{46,830}{6} = 7,805 \text{ units}$$

Budgeted Production = 7,500 units

$$\text{Standard rate per unit} = \frac{\text{Budgeted Overheads}}{\text{Budgeted Production}} = \frac{₹\ 33,750}{7,500} = ₹\ 450$$

Standard Overheads (or overheads recovered) = 7,610 @ ₹ 4.50 = ₹ 34,245

Actual cost of materials: 19,240 kg @ ₹ 31 = ₹ 5,96,440
Actual Wages: 46,830 hr @ ₹ 4.20 = ₹ 1,96,686

(ii) Statement of Variances

(a) Material cost variance: (SC - AC) = (₹ 5,47,200 - 5,96,440) = ₹ 49,240 (A)
which can be analyzed into:
(a) Material price variance: (SP - AP) AQ = (30 - 31) x 19,240 = ₹ 19,240 (A)
(b) Material usage variance: (SQ - AQ) SP = (18,240 - 19,240) x ₹30 = ₹30,000 (A)

(b) Labour cost variance: (SC - AC) = (₹ 1,82,640 - 1,96,686) = ₹ 14,046 (A)
which can be further analyzed as follows:
(a) Rate variance: (SR - AR) AT = (4.00 - 4.20) 46,830 = ₹ 9,366 (A)
(b) Efficiency variance: (AP - SP) SR = (7,610 - 7,805) x ₹ 24 = ₹ 4,680 (A)

(c) Factory O.H. cost variance: Std. O.H. - Actual O.H. = ₹34,245 - 36,340 = ₹2,095 (A)
which can be analyzed as follows:
(a) Expenditure or Budgeted variance: Budgeted O.H. - Actual O.H.
₹ 33,750 - 36,340 = ₹ 2,590 (A)
(b) Volume variance: SR (AP - BP) = ₹ 4.5 (7,610 - 7,500) = ₹ 495 (F)

Volume variance can be further divided as follows:
1. Efficiency variance: SR (AP - SP) = ₹ 4.50 (7,610 - 7,805) = ₹ 877.50 (A)
2. Capacity variance: SR (SP - BP) = ₹ 4.50 (7,805 - 7,500) = ₹ 1372.50 (F)

4. (a) A company manufactures two types of herbal product, A and B. Its budget shows profit figures after apportioning the fixed joint cost of ₹ 15 laksh in the proportion of the numbers of units sold. The budget for 2018 indicates:

Particulars	A	B
Profit (₹)	1,50,000	30,000
Selling price per unit (₹)	200	120
P/V Ratio (%)	40	50

Required to advise on the best option among the following, if the company expects that the number of units to be sold would be equal.

(i) Due to change in manufacturing process, the joint fixed cost would be reduced by 15% and the variable cost would be increased by 7%.

(ii) Price of A could be increased by 20% as it is expected that the price elasticity of demand would be unity over the range of price.
(iii) Simultaneous introduction of both the options, viz. (i) and (ii) above. 4+4+4=12

(b) What are the advantages of Inter-firm comparison? 4

Answer:

4. (a) Contribution of A = 40% x 200 = 80
Contribution of B = 50% x 120 = 60.

Average contribution per unit, considering equal units of both = (80 + 60)/2 = 70

Total units of production = (Total fixed costs + Profits)/70 = $\frac{15,00,000+1,80,000}{70}$ =

$\frac{16,80,000}{70}$ = 24,000

Of which 12000 of A and 12000 of B

Evaluation of Option:
(i)

	A		B	
Selling price/u	200	200	120	120
Variable Cost /u	120	128.4	60	64.20
Contribution/u	80	71.6	60	55.80
Contribution for 12000 units		859200		669600
Total Contribution				1528800
Fixed Cost				15,00,000 x 85% = 12,75,000
Profits				1528800-1275000 = 2,53,800

(ii) Volume for A originally = 12,000.
Since price elasticity of demand = 1, for 20 % increase in unit selling price, there will be a drop in demand by 20 %, i.e. 20% of 12,000 = 2400.

Revised sales quantity for A at increased price = 12000 - 2400 = 9600

	A		B
Selling price/u	200	240	120
Variable Cost /u	120	120	60
Contribution/u	80	120	60
Contribution for 9600 units For 12000 units		1152000	720000
Total Contribution			1872000
Fixed Cost			15,00,000
Profits			1872000-1500000 = 3,72,000

(iii) Simultaneous introduction of both:

	A		B	
Selling price/u	200	240	120	120
Variable Cost /u	120	128.4	60	64.20
Contribution/u	80	111.6	60	55.80
Contribution for 9600 units For 12000		1071360		
units				669600
Total Contribution				17,40,960
Fixed Cost				15,00,000 x 85% = 12,75,000
Profits				1740960-1275000 = 465960

Decision: Option (iii) has the maximum profits and should be chosen.

(b) The advantages of Inter-firm Comparison are appended below –

(1) Inter-firm Comparison makes the management of the organisation aware of strengths and weakness in relation to other organisations in same industry.
(2) As only the significant items are reported to the Management time and efforts are not unnecessary wasted.
(3) The management is able to keep up to data information of the trends and ratios and it becomes easier for them to take the necessary steps for improvement.
(4) It develops cost consciousness among the members of the industry.
(5) Information about the organisation is made available freely without the fear of disclosure of confidential data to outside market or public.
(6) Specialized knowledge and experience of professionally run and successful organisations are made available to smaller units who can take the advantages it may be possible for them to have such an infrastructure.
(7) The industry as a whole benefits from the process due to increased productivity, standardization of products, elimination of unfair comparison and the trade practices.
(8) Reliable and collective data enhance the organising power in deal in with various authorities and Government bodies.
(9) Inter firm comparison assists in a big way in identifying industry sickness and gives a timely warning so that effective remedial steps can be taken to save the organisation.

5. A regional audit firm offers audit, tax and consulting services. The segmented profit and loss position for the next year shows the following position:

	Audit (₹)	Tax (₹)	Consulting (₹)
1. Revenues	**60,000**	**1,00,000**	**1,20,000**
2. Costs:			
Service-level	**50,000**	**60,000**	**70,000**
Facility-level (apportioned)	**10,000**	**12,000**	**16,000**
Total	**60,000**	**72,000**	**86,000**
3. Operating Profit (1-2)	**Nil**	**28,000**	**34,000**

Partners are concerned about the profitability of their audit business and contemplate to close it down. In the event of closure of audit service, it might do more tax work. If audit service is discontinued, 50 per cent of the facility costs associated with auditing would be saved. More tax work would increase tax revenues by 45 per cent, but tax service-level costs would also increase by 45 per cent.

Required:

(a) Determine whether the firm should drop auditing service and the impact on its closure on profit. Assume that audit centre facility level costs can be allocated to two other centres based on revenues. Compare Profitability of Tax and Consulting Services before and after closure of Audit Centre.

(b) What other considerations are important to drop auditing service? 12+4=16

Answer:

5. (a) Whether to drop auditing service and the impact on profits:

Item of Cost/ Revenue	Incremental impact
Revenue loss from Audit	-60000

Savings in facility level costs	+5000
Decrease in Service Level cost (Audit), considered avoidable	+50,000
Increase in Tax Service Revenue by 45%	+45000
Increase in service level cost for Tax Service	-27000
Cumulative Impact	+13000

Decision: Close the Audit function and improve Tax Service.

	Tax		Consulting	
	Before	After	Before	After
Revenue	100000	145000	120000	120000
Costs:				
Service- level	60000	87000	70000	70000
Facility -level	12000	14736	16000	18264
Total Costs	72000	101736	86000	88264
Operating Profits	28000	43264	34000	31736

Total operating profits before dropping: 28000+34000 = 62000
Total operating profits after dropping Audit function: 43264+31736 = 75000
Impact = 13,000

(b) Other important considerations for dropping Audit function:

(i) The Audit function is not unprofitable or with Nil profit as shown in the question. Its revenues less its service level costs and avoidable facility level costs are 60,000 - 50,000 - 5000 = 5000. Hence, it is only due to allocated overhead that Audit function appears to be a non contributor.

(ii) While the release of Audit function strengthens the Tax Service, the overall impact being ₹ 13,000 increase in profits, it is a major risk that the firm will be taking, since it is an audit firm.

(iii) In the medium to long term, it could lose other potential clients who may go elsewhere to have more diversified services.

(iv) The firm should try to improve its costs and increase its fees to have more comfortable profits.

6. (a) Explain the concept of 'quality' and enumerate 'costs of quality' under different groups. 3+5=8

(b) What is Learning Curve? What factors affect Learning Curve? 4+4=8

Answer:

6. (a) The term quality is a perception which is personal to an individual. In plain terms, quality is "features" or "worth" or "value".

Conformance to specifications measures how well the product or service meets the targets and tolerances determined by its designers.

Fitness for use focuses on how well the product performs its intended function or use.

Value for price paid is a definition of quality that consumers often use for product or service usefulness. **Support services** provided are often how the quality of a product or service is judged. Quality does not apply only to the product or service itself; it also applies to the people, processes, and organizational environment associated with it.

Psychological criteria is a subjective definition that focuses on the judgmental evaluation of what constitutes product or service quality.

Quality has many other costs, which can be divided into two categories. The first category consists of costs necessary for achieving high quality, which are called quality control costs. These are of two types:

Prevention costs and appraisal costs. The second category consists of the cost consequences of poor quality, which are called quality failure costs. These include external failure costs and internal failure costs.

Prevention costs are all costs incurred in the process of preventing poor quality from occurring. They include quality planning costs, such as the costs of developing and implementing a quality plan. Also included are the costs of product and process design, from collecting customer information to designing processes that achieve conformance to specifications. Employee training in quality measurement is included as part of this cost, as well as the costs of maintaining records of information and data related to quality.

Appraisal costs are incurred in the process of uncovering defects. They include the cost of quality inspections, product testing, and performing audits to make sure that quality standards are being met. Also included in this category are the costs of worker time spent measuring quality and the cost of equipment used for quality appraisal.

Internal failure costs are associated with discovering poor product quality before the product reaches the customer site. One type of internal failure cost is rework, which is the cost of correcting the defective item. Sometimes the item is so defective that it cannot be corrected and must be thrown away. This is called scrap, and its costs include all the material, labor, and machine cost spent in producing the defective product.
External failure Costs are incurred when inferior products are delivered to customers. They include cost of handling customer complaints, warranty replacements, repairs of returned products and cost arising from a damaged company reputation.

(b) Learning Curve Theory is concerned with the idea that when a new job, process or activity commences for the first time it is likely that the workforce involved will not achieve maximum efficiency immediately. Repetition of the task is likely to make the people more confident and knowledgeable and will eventually result in a more efficient and rapid operation. Eventually the learning process will stop after continually repeating the job. As a consequence the time to complete a task will initially decline and then stabilise once efficient working is achieved. The cumulative average time per unit is assumed to decrease by a constant percentage every time that output doubles. Cumulative average time refers to the average time per unit for all units produced so far, from and including the first one made.

Learning curve is essentially a measure of the experience gained in production of an article by an individual or organization. As more units are produced, people involved in production become more efficient than before. Each subsequent unit takes fewer man-hours to produce. The amount of improvement will differ with each type of article produced. This improvement or experience gain is reflected in a decrease in man-hours or cost.

Factors affecting Learning Curve:

1. While pricing for bids, general tendency is to set up a very high initial labour cost so as to show a high learning curve. This should the learning curve useless and sometimes misleading.
2. The method of production i.e. whether it is labour oriented or machine oriented influences the slop of the learning.
3. When labour turnover rate is high management has to train new workers frequently. In such situations the company may never reach its maximum

efficiency potential. One of the important requisites of the learning curve concept is that there should be uninterrupted flow of work. The fewer the interruptions, the grater will be the improvement in efficiency.

4. Changes in a product or in the methods of production, designs, machinery, or the tools/used affect the slope of the learning curve. All these have the effect of starting learning a fresh because of new conditions If the changes are frequent, there may be no learning at all.
5. Also other factors influencing the learning curve are labour strikes, lock outs and shut downs due to other cause also/affect the learning curve. In each such case there is interruption in the progress of learning.

7. (a) A small project is composed of 8 activities whose estimated time are listed below:

Activity	1-2	2-3	2-4	3-5	4-6	5-6	5-7	6-7
Optimistic time (in weeks)	3	3	2	4	4	0	3	2
Most likely time (in weeks)	3	6	4	6	6	0	4	5
Pessimistic time (in weeks)	3	9	6	8	8	0	5	8

Required:

(i) Draw the project network.

(ii) Find the expected duration and variance for each activity.

(iii) Find the critical path and expected project length.

(iv) The probability that the project will be completed in 23 weeks.

Given that:

Z Value:	1.00	1.91	1.92	1.93	1.94
Probability:	0.9713	0.9719	0.9726	0.9732	0.9738

3+3+2+2=10

(b) The management of SAB Ltd. has suggested that a linear programming model might be used for selecting the best mix of five possible products — A, B, C, D and E. The following information are available:

	Per Unit of Product				
	A	B	C	D	E
Selling Price (₹):	96	84	76	62	54
Costs (₹):					
Material	30	28	32	30	32
Direct Labour	36	32	12	8	8
Fixed Overhead	18	16	6	4	4
Total Costs	84	76	50	42	44

Expected maximum unit demand per week for each product at the prices indicated:

A	B	C	D	E
3000	24000	1800	1200	1200

Cost of material includes a special component which is in short supply. It costs ₹ 6 per unit. Only 11,600 units are available to the company during the week. The number of units of the special component needed for a unit of each product is:

A	B	C	D	E
2	1	4	3	6

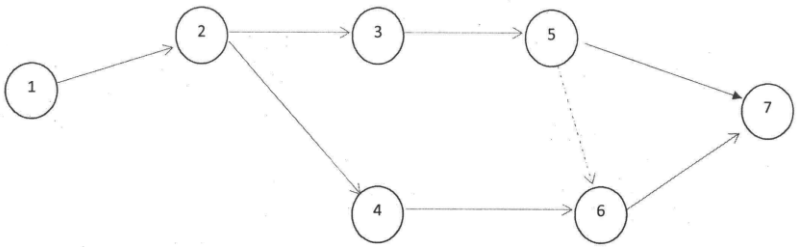
The management of SAB Ltd. has ruled that expenditure on materials must not exceed a sum of ₹ 60,000.

All other resources are freely available in sufficient quantities for planned need.

Formulate a linear programming model stating clearly the criterion you use. 6

Answer:

7. (a) (i) The network diagram for the given data is shown below:



Network Diagram

(ii) The earliest and latest expected time for each event is calculated by considering the expected time of each activity as shown in the following table:

TABLE: CALCULATION OF EXPECTED TIMES AND VARIANCES

Activity	t_o	t_m	T_p	$t_e = \frac{1}{6}[t_o + 4t_m + t_p]$	$\sigma^e = [\frac{1}{6}[t_p - t_o]^2$
1 – 2	3	3	3	3	0
2 – 3	3	6	9	6	1
2 - 4	2	4	6	4	4/9
3 – 5	4	6	8	6	4/9
4 – 6	4	6	8	6	4/9
5 – 6	0	0	0	0	0
5 – 7	3	4	5	4	1/9
6 - 7	2	5	8	5	1

The expected duration and variance for each activity is shown in the above table.

(iii) Critical path is : 1 — 2 — 3 — 5 — 6 — 7.

Expected project length. T_e = 3+6+6+0+5 = 20 weeks

(iv) Probability that the project will be completed in 23 weeks is given by:

$P(0 \le X \le 23) = P(0 \le Z \le \frac{23 - 20}{\sqrt{2.444}}) = P(0 \le Z \le 1.920) = 0.9726$ or 97.26%.

(b)

	A	B	C	D	E
Selling Price	96	84	76	62	54
Variable Cost	66	60	44	22	40
Contribution	30	24	32	40	14

Let a, b, c, d, e be the number of units respectively of A,B,C,D and E to be produced.
Objective function: Maximise contribution: Z = 30a+24b+32c+40d+14e

Subject to: Demand Constraint

a	≤	3000
b	≤	2400
c	≤	1800
d	≤	1200
e	≤	1200

Special Raw Material availability constraint
2a + b + 4c + 3d + 6e ≤ 11600

Special raw material cost constraint
12a + 6b + 24c + 18d + 36e ≤ 60,000

Non negativity constraint: a,b,c,d,e ≥ 0

8. Write short notes on any four of the following: 4x4= 16

(a) Backflush Accounting
(b) Relevant Cost Analysis
(c) Treatment of Variances in cost accounts
(d) Value Engineering
(e) Life Cycle Costing

Answer:

8. (a) **Backflush accounting** is when you wait until the manufacture of a product has been completed, and then record all of the related issuances of inventory from stock that were required to create the product. This approach has the advantage of avoiding all manual assignments of costs to products during the various production stages, thereby eliminating a large number of transactions and the associated labor. This system records the transaction only at the termination of the production and sales cycle. The emphasis is to measure cost at the beginning and at the end with greater emphasis on the end or outputs. Backflush accounting is entirely automated, with a computer handling all transactions.

The backflushing formula is:
Number of units produced x unit count listed in the bill of materials for each component

(b) Relevant Cost Analysis: For decision making purpose, it is necessary to classify costs and revenues based on whether they are relevant or irrelevant to the decisions. Relevant costs and revenues are those, that are influenced by the decisions. Irrelevant costs and revenues are those, that are not affected or influenced by the decisions.

Relevant costs are those expected future costs that are essential but differ for alternative courses of action. It is a future cost that would arise as a direct consequence of the decision under review.

The costs which should be used for decision making are often referred to as "relevant costs". CIMA defines relevant costs as 'costs appropriate to aiding the making of specific management decisions'.

Relevant costing is an incremental analysis which means that it considers only relevant costs i.e. costs that differ between alternatives and ignores sunk costs i.e. costs which have been incurred, which cannot be changed and hence are irrelevant to the scenario.

(c) In Standard Cost Accounting Systems which contain both actual and standard costs in the accounting records and financial statements, the question of adjustment of the cost variances at the end of the accounting period arises.

Three methods of disposal of variances and the advantages and disadvantages of each are discussed below:

1. Transfer to Profit and Loss Account.
2. Allocation of Variances to Finished Stock, Work-in-Progress and Cost of Sales Account.
3. Transfer of Variances to the Reserve Account.

Under the method 'Allocation of Variances to Finished Stock, Work-in-Progress and

Cost of Sales Account', the variances are distributed over stocks of finished and partly finished products and to the cost of sales. The distribution of each variance is made to the three accounts on a percentage basis according to the closing balance (value) of each account.

(d) Value Engineering is an organized/systematic approach directed at analyzing the function of systems, equipment, facilities, services, and supplies for the purpose of achieving their essential functions at the lowest life-cycle cost consistent with required performance, reliability, quality, and safety. Value Engineering is an effective problem solving technique. Value engineering is essentially a process which uses function analysis, team- work and creativity to improve value. Value Engineering is not just "good engineering."

It is not a suggestion program and it is not routine project or plan review. It is not typical cost reduction in that it doesn't "cheapen" the product or service, nor does it "cut corners."

Value Engineering methodology is a powerful tool for resolving system failures and designing improvements in performance of any process, product, service or organization.

(e) Life Cycle Costing; aims at cost ascertainment of a product, project etc. over its projected life. It is a system that tracts and accumulates the actual costs and revenues attributable to cost object (i.e., product) from its inception to its abandonment. Sometimes the terms; cradle-to-grave costing and womb-to-tomb costing convey the meaning of fully capturing all costs associated with the product from its initial to final stages.

Product Life Cycle is a pattern of expenditure, sale level, revenue and profit over the period from new idea generation to the deletion of product from product range. It spans the time from initial R&D on a product to when customer servicing and support is no longer offered for the product. Product life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their entire life cycle. Traces research, design and development costs and total magnitude of these costs for each individual product and compared with product revenue. Assists report generation for costs and revenues.