Advanced Accounting

Notes

INDEX

O.R

Learning Curve Theory

Mathematical Perceptions

$m \times n = \log m + \log n$

$m^n = n \log m$

$m/n = \log m - \log n$

Average Time p.u / lot

$Y = ax^b$

Y= Average Time p.u. /lot

a = Time Required for 1st unit / lot

x = Total no. of units/ lots for which average time is to be calculated

b = Learning curve index

Total Time

$xy = ax^{b+1}$

Question 1:

An electronics firm which has developed a new type of fire alarm system has been asked to quote for a prospective contract. The customer require separate price quotations for each of the following possibilities:

Order	No. of fire alarm System
First	100
Second	60
Third	40

The firm estimates the following cost per unit for the first order:

Direct Materials	Rs. 500
Direct Labour	
Deptt: A (Highly automatic) 20 hours at	Rs.10 per hour.
Deptt: B (Skilled Labour) 40 hours at	Rs. 15 per hour.
Variable overhead	20% of direct labour
Fixed overhead absorbed	
Deptt: A	Rs. 8 per hour
Deptt: B	Rs. 5 per hour

Determine a price per unit for each of the three orders, assuming the firm uses a markup of 25 % on total cost and allow for an 80% learning curve. Extract from 80% learning curve table:

X	1.0	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Y (%)	100.0	91.7	89.5	87.6	86.1	84.4	83.0	81.5	80.0

X represents the cumulative total volume produced to date expressed as a multiple of the initial order.

Y is the learning curve factor, for a given X value, expressed as a percentage of the cost of the initial order.

Question 2:

A company has 10 direct workers, who work for 25 days a month of 8 hours per day. The estimated down time is 25 % of the total available time. The company received an order for a new product. The first unit of the new product requires 40 direct labours hours to manufacture the products. The company expects 80% (index is -0.322) learning curve for this type of work. The company uses standard absorption costing and the cost data are as under:

Direct Material	Rs. 60 per unit
Direct Labour	Rs. 6 per direct labour hour
Variable overheads	Rs. 1 per direct labour hour
Fixed overheads	Rs. 7500 per month

Required:

i. Calculate the cost per unit of the first order of 30 units.
ii. If the company receives a repeat order for 20 units, what price will be quoted to yield a profit of 25% on selling price? (Nov. 2002)

Question 3:

An electronic firm has developed a new type of fire alarm system. A first unit assembled had a material cost of Rs. 18000 and took 400 hours of direct labour to assemble labour rate is Rs. 25 per hour. This type of assembly is known to experience a learning curve effect of 80% (index of learning – 0.3219). Demonstration of this unit to potential customers resulted in an order for 20 units during the next quarter. The firm wishes to popularize this system and will therefore pass on the benefit of cost savings due to learning effect to the customers while setting the sale price.

i. Determine the price to be set for the first lot of 20 units to be sold. The initial unit will not be sold as this is required for demonstration. The firm follows a practice of inputting a fixed overhead at 125% of direct labour cost and will set the selling price to earn a 20% gross margin on sale price.
ii. Assume that a further order for a lot of 60 units was received on a contract basis from a single customer. The price was set on the basis of the contracted total. However, after delivery of 30 units against the contract,

the contract was cancelled. Determine the deferred learning cost that may have to be written – off consequent to the cancellation of contract for balance not supplied.

Question 4:

Given that a = 10 hours and learning rate is 80%, you are required to calculate:-

i. The average time for 20 units
ii. The total time for 30 units
iii. The total time for units 31 to 40

Given that Log 2 = 0.301, antilog of 0.5811 = 3.812
Log 3 = 0.4771, antilog of 0.5244 = 3.345
Log 4 = 0.6021, antilog of 0.4841 = 3.049

Question 5:

Dynamo, a manufacturer of aircraft parts, has been asked to bid for 900 units of a particular type of component. Four months ago the company had produced a first lot of 400 units for another customer. The cost details of this first lot are given below.

Repeated assemble of this type of component experiences a learning effect of 85%. The cost benefit of this will be reflected in the bid price. Dynamo follows a policy of setting the selling price to earn 30% gross margin. Tooling cost has been fully recovered from the first lot sold. Determine the selling price unit for the second lot intended.

	(Rs.)	
Direct Material	30,00,000	
Direct Labour	20,00,000	8000 hours @ Rs. 250
Tooling cost	4,80,000	
Variable overheads	9,00,000	proportional to direct labour
General overhead	12,00,000	proportional to direct labour
Total	75,80,000	

Question 6:

A customer has asked your company to prepare a bid on supplying 800 units of a new product. Production will be in batches of 100 units. You estimate that labour costs for the first batch of 100 units will average Rs. 100 a unit. You also expect that a 90% learning curve will apply to the cumulative labour cost on this contract.

Required:

i. Prepare an estimate of the labour costs of fulfilling this contract.
ii. Estimate the incremental labour cost of extending the production run to produce and additional 800 units.
iii. Estimate the incremental labour cost of extending the production run from 800 units to 900 units.

Question 7:

XYZ & Co. has given the following data:
80% Average – Time Curve

Cumulative Units (x)	Average Hours	Total Hours	Marginal Hours
1	100	100	100
2	80	160	60
3	?	?	?
4	64	256	?

Required: Fill in the blanks.

Question 8:

A company manufactures specialized equipment. Direct labour required to make the first equipment is 2000 hours. Learning curve is 80%.

Direct labour cost is Rs. 4 per hour. Direct material needed for one equipment is Rs. 10000. Fixed overheads are Rs. 32000.

Required

1. using the learning curve concept, calculate the expected average unit cost of making

   a. 4 equipments b. 8 equipments

2. After manufacturing 8 equipments, if a repeat order for manufacture of another 8 equipments are received. What lowest price can be quoted for the repeat order?

Question 9:

Illustrate the use of learning curves for calculating the expected average unit cost of making-

(a) 4 machines
(b) 8 machines

Using the data given below:-

Data:

Direct labour needed to make first machine 1000 hours
Learning curve = 80%
Direct labour cost – Rs. 3/- per hour
Direct material cost – Rs. 1800 per machine
Fixed cost for either size orders – Rs. 8000

Question 10:

A company developing a new product makes a model for testing, and then a demonstration model and then goes for regular production. The time taken to make the model is 300 hours. And from past experience of similar models, it is known that a 90% learning curve applies. The average time for each of the first two production models will be:-

1. 270 hours
2. 243 hours
3. 216 hours
4. 219 hours

Support the correct figure with calculations.

Question 11:

(a). Your company has been approached by a customer to supply four units of a new product made to the customer's individual specification. The company experiences a 90% learning curve. The estimated labour time for the first unit of this product is 150 hours and the company's direct labour cost is Rs. 5 per hour. Estimate the labour cost for this order.

(b) After receiving the first order, if the customer places a repeat order, what Will be the labour cost for the second order.

(c) If the customer had ordered all eight units at the same time, calculate the labour cost per unit for the combined order.

SIMULATION

Although simulation can be of many types, our discussion will focus on the probabilistic simulation using the Monte Carlo method. Also called Computer Simulation, it can be described as a numerical technique that involves modeling a stochastic system with the objective of predicting the systems behavior. The chance element is a very significant feature of Monte Carlo Simulation and this approach can be used when the given process has a random, a chance, and component.

In using the Monte Carlo Method, a given problem is solved by simulating the original data with random number generators. Basically, its use requires two things. First, as mentioned earlier, we must have a model, that represents an image of the reality of the situation. Here the model refers to the probability distribution of the variable in question. What is significant here is that the variable may not be known to explicitly follow any of the theoretical distribution like Poisson, normal, and so on. The distribution may be obtained by direct observation or from past record. To illustrate, suppose that a bakery keeps the record of the sale of number of cake of a certain types. Information relating to 200 days' sales is:

Demand (No. of cakes):	5	6	7	8	9	10	11	12
Total (No. of days)	4	10	16	50	62	38	12	8
200								

Assuming that this is an adequate representation of the distribution of demand for the cake, we can derive the probability distribution of demand by expressing each of the frequency in terms of proportion. This is done by dividing each one the values by 200 – the total frequency. The resultant distribution follows:

Demand (No. of cakes):	5	6	7	8	9	10	11	12
Probability	0.02	0.05	0.08	0.25	0.31	0.19	0.06	0.04

Thus, there is 0.02 or 2% chance that 5 cakes would be demanded on a day, 0.05 or 5% chance that the demand would be for 6 cakes, … and so on. This distribution would serve as the model of the situation under consideration.

The second thing requires for simulation is a mechanism to simulate the model – something to capture the random nature of the given system. Thus we should have available a procedure that would help us to select, at random, values for the variables which can be used to approximate the state of the system. Such a mechanism can be any random number generator consisting of a device or a procedure by which random number can be determined and / or selected.

There are various ways in which random numbers (or apparently random, but not truly so) may be generated this could be result of some device, coin or die; published table of random number, mid quare method, or some other sophisticated method. It may be mentioned here that the 'random' numbers generated by some method may not be really random in nature. In fact such numbers are called pseudo – random numbers. There are some test with which numbers may be tested for there randomness but we should not consider them here and consider only briefly how the number may be obtained and used.

One way to generate random number is to fix up a spinning arrow on a common clock. When the arrow is spun, the number on which it stops would be taken to be random number for that trial. Naturally, any number of spinning of the arrow would result in an equal number of random numbers. In a similar way random numbers can be generated using spinning of a roulette wheel, tossing dice…. and like that. Although simple, these are very slow methods and can not meet the practical requirements where a large number of random numbers may be needed.

A more fast and convenient method is to make use of the published table of random numbers, like the one published by the Rand Corporation (of U.S.A) : A million random digits. A random number table is very efficient way to generate random data in most situations. The numbers in this table are in random arrangements. The underlying theory is that each number has an equal opportunity of being selected.

Still on a more sophisticated level, computers are used for generating the random numbers. With computers it is typically easier to generate random numbers by an arithmetic process as needed rather than to read the number from stored table. An early, probably the earliest method proposed for use on digital computer to generate random number is a mid square. To illustrate these methods, suppose that we wish to generate four – digits integers and the last number generated was 8937. To obtain the next number, in the sequence, we square the last one and use the middle four digits of the product. In this case the product is 79869969 so that the next pseudo – number is 8699. The next few numbers in the sequence are 6726, 2390, 7121 and so on. Thus, using this method, having drawn up a suitable computer program, a four digit number may be fed into the computer and a list of pseudo random numbers obtained.

Question 1:

The director of finance for a farm cooperative is concerned about the yields per acre she can expect from this year's corn crop. The probability distribution of the yields for the current weather conditions is given below:

Yield in kg per acre	Probability
120	0.18
140	0.26
160	0.44
180	0.12

She would like to see a simulation of the yields she might expect over the next 10 years for weather conditions similar to those she is now experiencing.

(i) Simulate the average yield she might expect per acre using the following random numbers: 20, 72, 34, 54, 30, 22, 48, 74, 76, 02

She is also interested in the effect of market price fluctuations on the cooperative' s farm revenue. She makes this estimate of per - kg prices for corn.

Price per kg (Rs)	Probability
2.00	0.05
2.10	0.15
2.20	0.30
2.30	0.25
2.40	0.15
2.50	0.10

(ii) Simulate the price she might expect to observe over the next 10 years using the following random numbers:
82, 95, 18, 96, 20, 84, 56, 11, 52, 03

Question 2:

The occurrence of rain in a city on a day is dependant upon whether or not it Rained on the previous day.

If it **rained** on the previous day, the rain distribution is Given by:

Event	Probability
No rain	0.50
1 cm rain	0.25
2 cm rain	0.15
3 cm rain	0.05
4 cm rain	0.03
5 cm rain	0.02

If it **did not rain** the previous day, the rain distribution is given by:

Event	Probability
No rain	0.75
1 cm rain	0.15
2 cm rain	0.06
3 cm rain	0.04

Simulate the city 's weather for 10 days and determine by simulation the total days without rain as well as the total rainfall during the period . Use the following random numbers:

67 63 39 55 29 78 70 06 78 76

for simulation . Assume that for the first day of the simulation it had not rained the day before.

Question 3:

The output of a production line is checked by an inspector for one or more of three different types of defects, called defects A, B and C. If defect A occurs, the item is scrapped. If defect B or C occurs, the item must be reworked. The time require to rework a B defect is 15 minutes and the time required to rework a C defect is 30 minutes. The probabilities of an A, B and C defects are 15, 20 and 10 respectively. For ten items coming off the assembly line, determine the number of items without any defects, the number scrapped and the total minutes of rework time: Use the following random numbers:

RN for defect A
48 55 91 40 93 01 83 63 47 52
RN for defect B
47 36 57 04 79 55 10 13 57 09
RN for defect C
82 95 18 96 20 84 56 11 52 03

Question 4:

The management of ABC Company is considering the question of marketing a new product. The fixed cost required in the project is Rs. 4,000. Three factors are uncertain viz. the selling price, variable cost and the annual sales volume.
The product has a life of only one year. The management has the data on these three factors as under:

Selling Price Rs	Probability	Variable Cost Rs.	Probability	Sales Volume (Units)	Probability
3	0.2	1	0.3	2,000	0.3
4	0.5	2	0.6	3,000	0.3
5	0.3	3	0.1	5,000	0.4

Consider the following sequence of thirty random numbers:

81	32	60	04	46	31	67	25	24	10	40
02	39	68	08	59	66	90	12	64	79	31
86	68	82	89	25	11	98	16.			

Using the sequence (First 3 random numbers for the first trial etc.) simulate the average profit for the above project on the basis of 10 trials.

Question 5:

Dr. STRONG is a dentist who schedules all her patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and the time actually needed to complete the work:

Category	Time required	Probability of Category
Filling	45 minutes	0.40
Crown	60 minutes	0.15
Cleaning	15 minutes	0.15
Extraction	45 minutes	0.10
Checkup	15 minutes	0.20

Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor.

Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8.00 a.m. Use the following random numbers for handling the above problem:

40 82 11 34 25 66 17 79

Question 6:

A book- store wishes to carry systems Analysis and Design in stock. Demand is probabilities and replenishment of stock takes 2 days (i.e. if an order is placed in March 1, it will be delivered at the end of the day on March 3). The probabilities of demand are given below:

Demand (daily)	0	1	2	3	4
Probability	0.05	0.10	0.30	0.45	0.10

Each time an order is placed, the store incurs an ordering cost of Rs. 10 per order. The store also incurs a carrying cost of Rs. 0.50 per book per day.

The inventory carrying costs is calculated on the basis of stock at the end of each day. The manager of the book-store wishes to compare two options for his inventory decision:

A. Order 5 books, when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

B. Order 8 books, when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

Currently (beginning of the 1st day) the store has stock of 8 books plus 6 books Ordered 2 days ago and expected to arrive next day.
Using Monte- Carlo simulation for 10 cycles recommends
Which option the manager should choose?

The two digits random numbers are given below:

89 34 78 63 61 81 39 16 13 73

Question 7:

A company manufactures 30 items per day. The sale of these items depends upon demand which has the following distribution:

Sales (Units)	Probability
27	0.10
28	0.15
29	0.20
30	0.35
31	0.15
32	0.05

The production cost and sale price of each units are Rs. 40 and Rs.50 respectively. Any unsold product is to be disposed at a loss of Rs.15 Per unit. There is a penalty of Rs.5 per unit if the demand is not met.

Using the following random numbers estimates total profit / loss for the company for the next 10 days:

10 99 64 99 95 01 79 11 16 20

If the company decides to produce 29 items per day, what is the advantage or disadvantage to the company?

Question 8:
A bakery keeps stock of popular brand of bread. Previous experience indicates the daily demand as given below:

Daily demand :	0	10	20	30	40	50
Probability :	.01	.20	.15	.50	.12	.02

Consider the following sequence of random numbers:
48, 78, 19, 51, 56, 77, 15, 14, 68, 9

Using above sequences, simulate the demand for the next 10 days.

(i) Find out the stock situation if the owner of the bakery decides to make 30 Breads everyday
(ii) Estimate the daily average demand for the bread on the basis of simulated Data.

Question 9:

A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 mopeds to 204 mopeds whose probability distribution is as given below:

Production per day	Probability
196	0.05
197	0.09
198	0.12
199	0.14
200	0.20
201	0.15
202	0.11
203	0.08
204	0.06

The finished mopeds are transported in a specially designed three storey lorry
That can accommodate only 200 mopeds. Using the following 15 random numbers
82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54, 10
Simulate process find out:

(i) What will be the average numbers of mopeds, waiting in the factory?

(ii) What will be the average number of empty spaces on the lorry?

Question 10:

A retailer deals in a perishable commodity. The daily demand and supply are variables. The data for the past 500 days show the following demand and supply:

Supply		Demand	
Availability (kg)	No. of days	Demand (kg)	No. of days
10	40	10	50
20	50	20	110
30	190	30	200
40	150	40	100
50	70	50	40

The retailer buys the commodity at Rs. 20 per kg and sells it at Rs. 30 per kg. Any Commodity remains at the end of the day, has no saleable value. Moreover, the loss (Unearned profit) on any unsatisfied demands Rs. 8 per kg. Given the following pair of Random numbers simulate 6 days sales, demand and profit.

Advanced Accounting