PAPER 9 - OPERATIONS MANAGEMENT & INFORMATION SYSTEM

The following table lists the learning objectives and the verbs that appear in the syllabus learning aims and examination questions:

	Learning objectives	Verbs used	Definition
LEVEL B	KNOWLEDGE What you are expected to know	List	Make a list of
		State	Express, fully or clearly, the details/facts
		Define	Give the exact meaning of
	COMPREHENSION What you are expected to understand	Describe	Communicate the key features of
		Distinguish	Highlight the differences between
		Explain	Make clear or intelligible/ state the meaning or purpose of
		Identity	Recognize, establish or select after consideration
		Illustrate	Use an example to describe or explain something
	APPLICATION How you are expected to apply your knowledge	Apply	Put to practical use
		Calculate	Ascertain or reckon mathematically
		Demonstrate	Prove with certainty or exhibit by practical means
		Prepare	Make or get ready for use
		Reconcile	Make or prove consistent/ compatible
		Solve	Find an answer to
		Tabulate	Arrange in a table
	ANALYSIS How you are expected to analyse the detail of what you have learned	Analyse	Examine in detail the structure of
		Categorise	Place into a defined class or division
		Compare and contrast	Show the similarities and/or differences between
		Construct	Build up or compile
		Prioritise	Place in order of priority or sequence for action
		Produce	Create or bring into existence

Paper – 9 – Operations Management & Information Systems

Full Marks: 100 **Time allowed-3hrs**

This paper contains 3 questions. All questions are compulsory, subject to instruction provided against each question. All workings must form part of your answer. Assumptions, if any, must be clearly indicted.

Question No. 1: Answer all questions. [20 marks]

1. (a) Describe Process Selection.

(b) The demand for 100 Watt bulbs in the past 5 months is given as below:

Month	Demand
April	700
May	700
June	800
July	600
August	500

Calculate the moving average for a period of 5 months.

(c) An assembly line of an item A has the following output in a 10 week period:

Week No	Standard hours Produced
1	350
2	375
3	380
4	400
5	300
6	325
7	340
8	370
9	390
10	350

Calculate the demonstrated capacity of the assembly line per week.

(d) Write a note on Line Balancing.

(e) List the ten dimensions of service quality.

(f) Explain the term Rotable Spares.

(g) Explain System Components matrix.

(h) Describe Natural Language Interfaces.

(i) Explain Programme-data Independence.

(j) State the different parts of a Decision Table. **[2×10=20]**

Answer 1:

(a) Process selection refers to the way production of goods or services is organised. It is the basis for decisions regarding capacity planning, facilities (or plant) layout, equipments and design of work systems. Process selection is necessary when a firm takes up production of new products or services to be offered to the customers.

(b) The moving average for a period of 5 months

$$MA=\frac{700+700+800+600+500}{5}=660$$

(c) Demonstrated capacity is the average of the total standard hours produced over a number of periods.

Total number of weeks = 10

Total standard hours produced = 3,580 standard hours

Average per week = 3,580/10 = 358 standard hours

(d) Line balancing is arranging a production line so that there is an even flow of production from one work station to the next, i.e. there are no delays at any work station that will leave the next work station with idle time.

Line balancing is also defined as "the apportionment of sequential work activities into work stations in order to gain a high utilization of labour and equipment and therefore minimize idle time."

(e) Ten dimensions of service quality are - 1. Reliability 2. Responsiveness 3. Competence 4. Access 5. Courtesy 6. Communication 7. Credibility 8. Understanding 9. Security/Safety 10. Tangibles.

(f) Rotable spares are repairable and re-usable spares, such as a jet engine or an electric motor which can be reconditioned after failure and put back in operation. This situation can be visualised in a Multiple Channel Single Service Queuing theory format, where the defective equipments are the arrivals and the spares are the servers. The service times are given by the distribution of time to recondition a spare. The inter-arrival times of the defective items can also be modelled in terms of a probability distribution.

(g) System Components matrix : It highlights how the basic activities of input, processing, output, storage and controls are accomplished in an information system, and how the use of hardware, software and people resources can convert data resources into information products.

(h) Natural Language Interfaces- These interfaces accept requests written in English or some other language and attempt to "understand" them. A natural language interface usually has its own "schema," which is similar to the database conceptual schema. The natural language interface refers to the words in its schema, as well as to a set of standard words, to interpret the request. If the interpretation is successful, the interface generates a high-level query corresponding to the natural language request and submits it to the DBMS for processing; otherwise, a dialogue is started with the user to clarify the request.

(i) Programme-data Independence:
In traditional file processing, the structure of data files is embedded in the access programs, so any changes to the structure of a file may require changing all programs that access this file. By contrast, DBMS access programs do not require such changes in most cases. The structure of data files is stored in the DBMS catalog separately from the access programs. We call this property program-data independence.

(j) Different parts of a Decision table: The four parts of the decision table are as follows:
(i) Condition Stub - lists the comparisons or conditions;

(ii) Action Stub - lists the actions;

(iii) Condition entries - list in its various columns the possible permutations;

(iv) Action entries - lists, in its columns corresponding to the condition entries the actions contingent upon the set of answers to questions of that column.

Operations Management

Answer any three questions

2.(a) (i) Describe the different Qualitative Approaches.

(ii) A repairman is to be hired by a company to repair machines that breakdown at an average rate of 3/ hour. Breakdown occurs randomly (Poisson distribution) over time. Non-productive time on any machine is considered to cost the company ₹10 per hour. The management has narrowed down the choice to 2 repairmen; one 'slow but cheap' and other 'fast but expensive'. The 'slow but cheap' repairman has a rate of ₹5 per hour and he will service breakdown machines at an average rate of 4/hour. The 'fast but expensive' repairman has a rate of ₹7 per hour and he will service breakdown machines at an average rate of 6/hour. Which repairman should the company hire? Assume exponential repair time for both repairmen.

(iii) Discuss the three process strategies. [5+6+5=16]

Answer:

2. (a) (i) Qualitative approaches include five forecasting techniques:

- Grass-root Forecasting
- Focused Forecasting
- Historical Analogy
- Panel Consensus
- Delphi Method

Grass-root Forecasting: People at the grass-root level in the organization, who are in direct contact with the phenomenon under study, are asked to give inputs in forecasting.

Focused Forecasting: This method integrates common sense, grass-root inputs and computer simulation processes to assess the forecasts.

Historical Analogy: Information of past events is used to give insights into prediction on related future developments. It is assumed that the future events would follow similar pattern as that of the past events.

Panel Consensus: A group of knowledgeable persons are invited for an open discussion on a topic selected for forecasting. It is believed that a single person might not be able to consider all the aspects on the topic.

Delphi Method: A number of experts associated with the subject is asked to give their response to pre-selected questions, which would help in forecasting. The experts could be persons from within the organization or from outside the organization.

As the experts come from diverse backgrounds, they look at the issue independently from their own perspectives. On getting the feedback, they are able to appreciate the views of the experts from other expertise fields also. This gives them better understanding of the issue. The result of Delphi is arrived by pooling up the knowledge of various experts and brings very good results.

2. (a) (ii) (Queuing Theory)

μ = rate of service Labour rate	'Slow but cheap' repairman	'Fast but expensive' repairman
	4/ hour ₹5/hour	6/hour ₹7/hour

In the given situation, breakdown rate = λ = 3 machines per hour

(i) For 'slow but cheap' repairman:

Average (expected) number of breakdowns in the system:

$$L_S = \frac{\lambda}{\mu - \lambda} = \frac{3}{4-3} = 3 \text{ machines}$$

Cost of idle machine hours = 3 ×1× ₹10 = ₹30

Total charges = (Wages + Cost of idle machines) per hour = ₹5 + ₹30 = ₹35

(ii) For 'Fast but Expensive' repairman:
Average (expected) number of breakdowns in the system:

$$L_S = \frac{\lambda}{\mu - \lambda} = \frac{3}{6-3} = 1 \text{ machine}$$

Cost of idle machine hours = 1 × 1 × ₹10 = ₹10

Total charges = (Wages + cost of idle machine) per hour = ₹7+ ₹10 = ₹17

Decision-When total cost of two workmen is taken into consideration, it will be economical to hire 'fast but expensive' repairman.

2. (a) (iii) Three Process Strategies

Virtually every good or service is made by using some variation of one of three process strategies. They are: (i) process focus (ii) repetitive focus and (iii) product focus.

Each of these three strategies are discussed below:

(i) Process Focus: Majority (about 75 per cent) of global production is devoted to low volume, high variety products in manufacturing facilities called job shops. Such facilities are organised around performing processes. For example, the processes might be welding, grinding or painting carried out in departments devoted to these processes. Such facilities are process focused in terms of equipment, machines, layout and supervision. They provide a high degree of product flexibility as products move intermittently between processes. Each process is designed to perform a wide variety of activities and handle frequent changes. Such processes are called intermittent processes. These facilities have high variable costs and low utilisation of facilities.

(ii) Repetitive Focus: A repetitive process is a product oriented production process that uses modules. It falls between product focus and process focus. It uses modules which are parts or components prepared often in a continuous or mass production process.

A good example of repetitive process is the assembly line which is used for assembling automobiles and household appliances and is less flexible than process-focused facility. Personal computer is an example of a repetitive process using modules in which the modules are assembled to get a custom product with the desired configuration.

(iii) Product Focus: It is a facility organised around products, a product oriented, high-volume low-variety process. It is also referred to as continuous process because it has very long continuous production run. Examples of product focused processes are steel, glass,

paper, electric bulbs, chemicals and pharmaceutical products, bolts and nuts etc. Product-focused facilities need standardisation and effective quality control. The specialised nature of the facility requires high fixed cost, but low variable costs reward high facility utilisation.

2. (b) (i) Contribution per unit (₹)

	WH1	**WH2**	**WH3**	**WH4**	**Total supplies**
Plant 1	**48**	**60**	**56**	**58**	**14**
Plant 2	**40**	**55**	**53**	**60**	**26**
Plant 3	**50**	**100**	**60**	**62**	**36**
Total Demand	**20**	**32**	**25**	**21**	

Find the initial solution by North-West Corner method. Is the initial solution feasible?

(ii) A firm makes two products X and Y and has a total production capacity of 16 tonnes per day. X and Y require the same production capacity. The firm has a permanent contract to supply at least 3 tonnes of X and 6 tonnes of Y per day to another company. Each tone of X requires 14 machines hours of production time and each tone of Y requires 20 machines hours of production time. The daily maximum possible number of machine hours is 280. All the firm's output can be sold, and the profit made is ₹20 per tonne of X and ₹25 per tonne of Y. [8+8=16]

Answer:

2.(b) (i) Total demand is 98. Total supply is 76. We introduce dummy plant with supply as 22 and contribution per unit to be zero

Contribution per unit (₹)

	WH1	WH2	WH3	WH4	Total supplies
Plant 1	48	60	56	58	14
Plant 2	40	55	53	60	26
Plant 3	50	100	60	62	36
Dummy Plant	0	0	0	0	22
Total Demand	20	32	25	21	98

Opportunity Loss Matrix

	WH1	WH2	WH3	WH4	Total supplies
Plant 1	[14]				14
Plant 2	[6]	[20]			26
Plant 3		[12]	[24]		36
Dummy Plant			[1]	[21]	22
Total Demand	20	32	25	21	98

Initial Solution:

From	Plant 1	Plant 2	Plant 2	Plant 3	Plant 3	Plant 4	Plant 4

To	WH 1	WH 1	WH 2	WH 2	WH 3	WH 3	WH 4
Units	14	6	20	12	24	Dummy	Dummy
Feasibility test	m + n -1 = 7		No. of allocations = 7		The solution is feasible		

2. (b) (ii) Let's the firm produce x tones of X and y tones of Y.

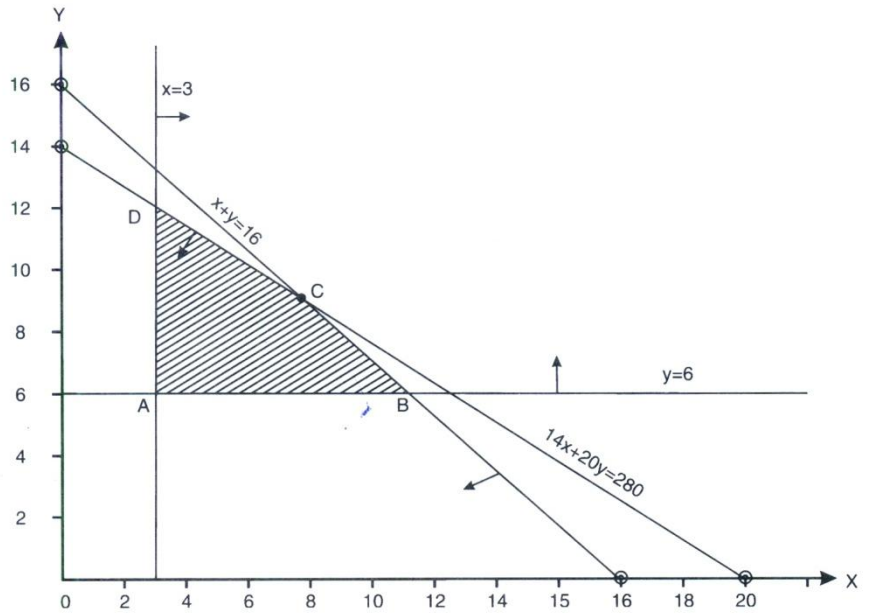
Objective function: Maximize: 20x + 25y

Subject to:

$x \geq 3$	$y \geq 6$	$x + y \leq 16$
$14x + 20y \leq 280$	$x, y \geq 0$	

Let's convert the inequalities to equalities:

$x = 3$	$y = 6$	$x = 0, y = 16$
$y = 0, x = 16$	$x = 0, y = 14$	$y = 0, x = 20$



Corner Points		x	y	Contribution
A		3	6	60 +150 = 210
B	x + y = 16 y = 6	10	6	200 + 150 = 350
C	x + y = 16 14x + 20y = 280	6.67	9.33	6.67 × 20+9.33 × 25 = 366.67
D	14x + 20y = 280 x = 3	3	11.90	3 × 20+ 11.90 × 25 = 357.50

Suggested Product mix: 6.67 units of X and 9.33 units of Y. The incomplete units will be completed next day. Contribution ₹366.67

2. (c) (i) The NRB Company is planning to design, develop and market a new racing cycle. The Project is composed of the following activities:

Activity	Description	Predecessors	Time (weeks)
A	Design frame	-	4
B	Design wheels	-	3
C	Design gears	-	3
D	Design handle bars	C	2
E	Test steering	A,B,D	1
F	Test gears	A,B,D	2
G	Performance test	E,F	3
H	Manufacturing layout	A,B,D	3
I	Manufacturing demonstration	H	5
J	Preparing advertising	G	2
K	Preparing user's manual	G	4
L	Distribute to dealers	I,J,K	2

Draw the network; find critical path and total duration of project. NRB would like to complete the project in 15 weeks. Would it help if they:

(1) Work over time to get the frame designed in only 3 weeks?

(2) Assign more designers to design the gears? If so, from what activity should the designers be taken from?

(ii) The Everalert Ltd. which has a satisfactory preventive maintenance system in its plant, has installed a new Hot Air Generator based on electricity instead of fuel oil for drying the finished products. The Hot Air generator requires periodic shutdown maintenance. If the shutdown is scheduled yearly, the cost of maintenance will be as under:

Maintenance cost	₹15,000	₹20,000	₹25,000
Probability	0.30	0.40	0.30

The costs are expected to be almost linear i.e. if the shutdown is scheduled twice per year, the maintenance cost will be double.

The probability distribution of breakdown cost is estimated as under:

Breakdown costs per annum	₹75,000	₹80,000	₹1,00,000
Shutdown once a year	0.20	0.50	0.30
Shutdown twice a year	0.50	0.30	0.20

Stimulate the total costs – maintenance and breakdown- and recommend whether the shutdown should be resorted once or twice a year.

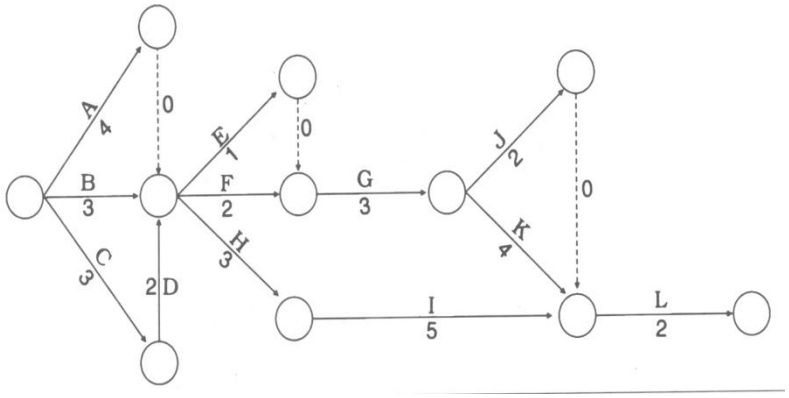
Random numbers

Maintenance costs (shut down once a year)	27,44,22,32,97
Maintenance costs (shut down twice a year)	42,04,82,38,91
Breakdown costs (shut down once a year)	03,50,73,87,59
Breakdown costs (shut down twice a year)	54,65,49,03,56

[8+8=16]

Answer:

2. (c) (i)



Paths	Duration	Paths	Duration
AEGJL	4+1+3+2+2= 12	CDFGKL	3+2+2+3+4+2 = 16
AEGKL	4+1+3+4+2 = 14		**Critical path**
BEGJL	3+1+3+2+2 = 11	CDFGJL	3+2+2+3+2+2 = 14
BEGKL	3+1+3+4+2 = 13	CDEGJL	3+2+1+3+2+2 = 13
BFGJL	3+2+3+2+2 = 12	CDHIL	3+2+3+5+2 = 15
BFGKL	3+2+3+4+2 = 14	CDEGKL	3+2+1+3+4+2 = 15

(i) Crashing the frame design by one week won't reduce the duration of the project as frame designing is not a critical activity.

(ii) Activity C is a critical activity. Hence, if more designers are assigned to this activity, duration of C will be reduced. The result will be the reduced duration of the project. The designers may be shifted from activity A or B as these activities are non- critical activities.

2. (c) (ii)

Probability Distribution (Maintenance cost)

Cost (₹)	Probability	Cum. Probability	Range	Range for simulation
15,000	0.30	0.30	0 – 0.30	0 – 0.29
20,000	0.40	0.70	0.30 – 0.70	0.30 – 0.69
25,000	0.30	1.00	0.70 – 1.00	0.70 – 0.99

Probability Distribution (Breakdown cost; shutdown once a year)

Cost (₹)	Probability	Cum. Probability	Range	Range for simulation
75,000	0.20	0.20	0 – 0.20	0 – 0.19
80,000	0.50	0.70	0.20 – 0.70	0.20 – 0.69
100,000	0.30	1.00	0.70 – 1.00	0.70 – 0.99

Probability Distribution (Breakdown cost; shutdown twice a year)

Cost (₹)	Probability	Cum. Probability	Range	Range for simulation
75,000	0.50	0.50	0 – 0.50	0 – 0.49
80,000	0.30	0.80	0.50 – 0.80	0.50 – 0.79

100,000	0.20	1.00	0.80 – 1.00	0.80 – 0.99

Shut down once a year

Maintenance cost p.a.	Breakdown cost p.a.
15,000	75,000
20,000	80,000
15,000	1,00,000
20,000	1,00,000
25,000	80,000
Total ₹95,000	Total ₹4,35,000
Average ₹19,000	Average ₹87,000
Total Cost ₹19,000 + ₹87,000 = ₹1,06,000	

Shut down twice a year

Maintenance cost p.a.	Breakdown cost p.a.
20,000 × 2 = 40,000	80,000
15,000 × 2 = 30,000	80,000
25,000 × 2 = 50,000	75,000
20,000 × 2 = 40,000	75,000
25,000 × 2 = 50,000	80,000
Total ₹2,10,000	Total ₹3,90,000
Average ₹42,000	Average ₹78,000
Total Cost ₹42,000 + ₹78,000 = ₹1,20,000	
Shutdown once a year is recommended on account of lower annual cost.	

2. (d) (i) ABC Company is engaged in manufacturing 5 brands of packet snacks. It is having five manufacturing setups, each capable of manufacturing any of its brands, one at a time. The cost to make a brand on these setups vary according to following table –

	S_1	S_2	S_3	S_4	S_5
B_1	**4**	**6**	**7**	**5**	**11**
B_2	**7**	**3**	**6**	**9**	**5**
B_3	**8**	**5**	**4**	**6**	**9**
B_4	**9**	**12**	**7**	**11**	**10**
B_5	**7**	**5**	**9**	**8**	**11**

Assuming five setups are S_1, S_2, S_3 , S_4 and S_5 and five brands are B_1, B_2, B_3, B_4, and B_5 , Find the optimum assignment of the products on these setups resulting in the minimum cost.

(ii) Explain Gantt Chart. [10+6=16]

Answer:

2. (d) (i)

This is an assignment problem whose objective is to assign on manufacturing set up to one brand so that the total cost of production is minimum. To determine the appropriate assignment, let us apply the assignment algorithm.

Subtract the minimum element of each row from all elements of that row to get the following matrix -

Brands	Manufacturing Setups				
	S_1	S_2	S_3	S_4	S_5
B_1	0	2	3	1	7
B_2	4	0	3	6	2
B_3	4	1	0	2	5
B_4	2	5	0	4	3
B_5	2	0	4	3	6

Now subtract the minimum elements of each column from all elements of that column –

Brands	Manufacturing Setups				
	S_1	S_2	S_3	S_4	S_5
B_1	(0)	2	3	0	5
B_2	4	0	3	5	(0)
B_3	4	1	(0)	1	3
B_4	2	5	0	3	1
B_5	2	(0)	4	2	4

The minimum number of lines drawn to cover all zeros is equal to 4 which is one less than the order of the matrix (= 5), the above table will not yield the optimal assignment. For obtaining the optimal assignment, we increase the number of zeroes by subtracting the minimum uncovered element from all uncovered elements and adding it to elements lying at the intersection of two lines; we get the following matrix -

Brands	Manufacturing Setups				
	S_1	S_2	S_3	S_4	S_5
B_1	(0)	3	4	0	5
B_2	4	1	4	5	(0)
B_3	3	1	0	(0)	2
B_4	1	5	(0)	2	0
B_5	1	(0)	4	1	3

Since the minimum number of lines required to cover all zeros is five, the above table will give the optimal solution. The required assignment is made as below –

Brand	Setup	Cost
B_1	S_1	4
B_2	S_5	5

B_3	S_4	6
B_4	S_3	7
B_5	S_2	5
Total		27

2. (d) (ii) Gantt Chart

Gantt chart is one of the oldest techniques used for planning, scheduling and controlling of projects. Gantt chart was developed by H.L. Gantt in 1917 and is in use till today. Gantt charts were used even before computer came on the scene. Even today, Gantt chart applies to manufacturing as well as service organizations.

Gantt chart is a graphical representation of a series of activities drawn to a. time scale. Horizontal axis (X-axis) represents time and vertical axis (Y-axis) shows the activities to be performed. The Gantt chart shows activities to specific jobs at individual/work centers by horizontal bars. Also known as a 'bar chart' because of its graphic presentation of the information, the position and the length of the horizontal bar indicates the start and completion date of the activity. In the initial days Gantt charts used the following symbols:

Symbols	Explanation of the symbol
[	Start of an activity
]	End of an activity
[------]	Actual progress of the activity
v	Point of time to show 'where you are'

Over a period, only bars are used to show the start, end and duration of the activity. When the Gantt chart is used as a controlling technique, the planned and actual performances of the activities are presented on the same chart by two horizontal bars with different colors or by different presentation.

Gantt charts are initially prepared for planning purposes. However, as the work progresses, the actual performance or progress is shown on the Gantt chart to have a clear picture of any variation from the planned time. This provides a comparison between planned-time and actual time taken in completion of an activity.

Information System

Answer any two questions.

3. (a) (i) Discuss the various Database System Utilities.

(ii) State the basic features of Decision Supports System.

(iii) 'Development in Computer has evolved business opportunities for Different Business activities relating to Hardware and Software.'- Discuss. [6+3+7=16]

Answer:

3. (a) (i) Database System Utilities:

(i) Loading: A loading utility is used to load existing data files—such as text files or sequential files—into the database. Usually, the current (source) format of the data file and the desired (target) database file structure are specified to the utility, which then automatically reformats the data and stores it in the database. With the proliferation of

DBMSs, transferring data from one DBMS to another is becoming common in many organizations. Some vendors are offering products that generate the appropriate loading programs, given the existing source and target database storage descriptions (internal schemas). Such tools are also called conversion tools.

(ii) Backup: A backup utility creates a backup copy of the database, usually by dumping the entire database onto tape. The backup copy can be used to restore the database in case of catastrophic failure. Incremental backups are also often used, where only changes since the previous backup are recorded. Incremental backup is more complex but it saves space.

(iii) File reorganization: This utility can be used to reorganize a database file into a different file organization to improve performance.

(iv) Performance monitoring: Such a utility monitors database usage and provides statistics to the DBA. The DBA uses the statistics in making decisions such as whether or not to reorganize files to improve performance.

Other utilities may be available for sorting files, handling data compression, monitoring access by users, and performing other functions.

3. (a) (ii) Decision Supports System is a sophisticated decision making model with the help of high powered software to take semi-structured decisions. The basic features of a DSS are:

- It is based on one or more corporate databases
- It must be supported by a set of quantitative models
- It has the ability to solve unstructured problems
- It should have the network computing facilities embedded in the system
- It is used for solution in a complex business situation
- It provides supports to Executive Information system for decision making
- Software at different locations facilitates group decision making.

3. (a) (iii) Business opportunities due to Development of Computers

Development in Computer has evolved following business opportunities for Different Business activities relating to Hardware and Software.

1. Computer Manufacturing: This function is generally taken up by big companies. Earlier days manufacturers used to market their own products. Leading manufacturers in the world were IBM (International Business Machine), DEC (Digital Equipment Corporation), CDC (Control Data Corporation), Burrough, Honeywell, NCR, ICL, Hewlett Packard etc.
2. Peripheral Equipment Manufacturing**:** Some companies are involved in manufacturing peripheral devices like disk drives, tape drives, printers, plotters, monitors, communication equipments. Leading peripheral manufacturers in the world are Intel Corporation, Motorola, Texus Instruments, Toshiba, Phillips, Fujitsu, Hitachi, NEC Corporation etc.
3. Computer Leasing**:** Earlier days Computer Leasing was a very attractive business. The cost of Computer was high. Users generally were not ready to afford huge investment. Some computer manufacturer and some companies were involved in the business of computers leasing. Lease Rent was high. IBM used to provide machines in lease.
4. Software Developers**:** Companies and individuals undertake the responsibilities of developing software for third party companies. The job of contract used to be system designing, program development and system implementation.

5. Time-Sharing Companies**:** In earlier days when hardware used to be costly and users were using only selective application systems for data processing, the time sharing facilities provided by different companies on their Computer were found to be cost-efficient and widely acceptable to many users. Some Companies took the opportunities for business purpose. Generally, companies used to buy a mainframe computers with multi-users facilities and charges used to on the basis of usage time of different components like CPU, Printers, Disk, Magnetic tape etc.
6. Networking Parlour**:** With the acceptance of networking to be the most efficient communication, use of e-mail and net-working surfing has gone up. It will further multiply when the e-commerce will take a formidable shape to be effectively operative. Providing networking facilities by small shop has become a good business in big and small towns.
7. BPO Services**:** The advantages of fast communication through internet technology has opened a new dimension for Business Process Outsourcing of commercial jobs. The data in being transmitted from one part of the globe to other for processing. The same being processed.

3. (b) (i) Describe On- Line Transaction Processing (OLTP).
(ii) 'Databases can be used to provide persistent storage for program objects and data structures.' – Discuss.
(iii) Explain when it is not desirable to Use a DBMS. [6+6+4=16]

Answer:

3. (b) (i) On- Line Transaction Processing (OLTP)

On-line transaction processing is carried in a client/server system. In today's competitive environment, information at right time plays a great role in controlling costs of various resources and providing best possible services to the customers. In other words, business environment has been characterized by growing competition; shrinking cycle time and accelerating pace of technological innovations and companies have to focus on better information management. Better information means right information at right time. OLTP are being adopted in wider scale to have the following advantages:

- It can serve multiple users at a point of time
- Technology serves the facilities to collect information from multi-locations
- High flexibility in information processing etc.

In case of Sales and Distribution System in an organization where transactions take place at different locations on-line transaction processing is followed to carry out the following basic functions:

- Inquiry handling
- Quotation preparation
- Receiving order from customers
- Checking availability of materials / products
- Scheduling delivery
- Monitoring sales transactions
- Invoicing
- Managing Bills Receivables etc.

3. (b) (ii) Providing Persistent Storage for Program Objects and Data Structures

Databases can be used to provide persistent storage for program objects and data structures. This is one of the main reasons for the emergence of the object-oriented database systems. Programming languages typically have complex data structures, such as record types in PASCAL or class definitions in C++. The values of program variables are discarded once a program terminates, unless the programmer explicitly stores them in permanent files, which often involves converting these complex structures into a format suitable for file storage. When the need arises to read this data once more, the programmer must convert from the file format to the program variable structure. Object-oriented database systems are compatible with programming languages such as C++ and JAVA, and the DBMS software automatically performs any necessary conversions. Hence, a complex object in C++ can be stored permanently in an object-oriented DBMS, such as Object Store or O2 (now called Ardent). Such an object is said to be persistent, since it survives the termination of program execution and can later be directly retrieved by another C++ program.

The persistent storage of program objects and data structures is an important function of database systems. Traditional database systems often suffered from the so-called impedance mismatch problem, since the data structures provided by the DBMS were incompatible with the programming language's data structures. Object-oriented database systems typically offer data structure compatibility with one or more object-oriented programming languages.

3. (b) (iii) When not to use a DBMS

In spite of the advantages of using a DBMS, there are a few situations in which such a system may involve unnecessary overhead costs as that would not be incurred in traditional file processing. The overhead costs of using a DBMS are due to the following:

- High initial investment in hardware, software, and training.
- Generality that a DBMS provides for defining and processing data.
- Overhead for providing security, concurrency control, recovery, and integrity functions.

Additional problems may arise if the database designers and DBA do not properly design the database or if the database systems applications are not implemented properly. Hence, it may be more desirable to use regular files under the following circumstances:

- The database and applications are simple, well defined, and not expected to change.
- There are stringent real-time requirements for some programs that may not be met because of DBMS overhead.
- Multiple-user access to data is not required.

3. (c) (i) 'Any transaction resulting in a change in stock is defined as Goods Movement.'- Discuss.

(ii) Write a note on Public Key Infrastructure Processes.

(iii) List the benefits of EDI. [4+6+6=16]

Answer:

3. (c) (i) Goods Movement

Any transaction resulting in a change in stock is defined as Goods Movement.

When we post a goods movement in SAP, the following chain of events starts in the system:

- A material document is generated, which is used as proof of the movement and as a source of information for any other applications involved.

- If the movement is relevant for Financial Accounting, one or more accounting documents are generated. The stock quantities of the material are updated.
- The stock values in the material master record are updated, as are the Stock and Consumption accounts.
- All updates are based on the information contained in the material document and the financial accounting document. For example, in the case of a goods issue for a cost centre, the consumption values of the items are also updated.

3. (c) (ii) PKI Processes

Public Key Infrastructure (PKI) is about the management and regulation of key pairs by allocating duties between contracting parties (Controller/CA/Subscribers), laying down the licensing and business norms for CAs and establishing business processes/ applications to construct contractual relationships in a digitized world. The idea is to develop a sound public key infrastructure for an efficient allocation and verification of digital signatures certificates.

Step 1- Subscriber applies to Certifying Authority (CA) for Digital Signature Certificate.

Step 2 - CA verifies identity of Subscriber and issues Digital Signature Certificate.

Step 3 - CA forwards Digital Signature Certificate to Repository maintained by the Controller.

Step 4 - Subscriber digitally signs electronic message with Private Key to ensure Sender Authenticity, Message Integrity and Non-Repudiation and sends to Relying Party.

Step 5 — Relying Party receives message, verifies Digital Signature with Subscriber's Public Key, and goes to Repository to check status and validity of Subscriber's Certificate.

Step 6 - Repository does the status check on Subscriber's Certificate and informs back to the Relying Party.

3. (c) (iii) Benefits of EDI:

(1) The use of EDI eliminated many problems associated with traditional information flow such as the delay associated with making of documents.
(2) As data is not repeatedly keyed (typed) therefore the chances of error are reduced.
(3) Time required to re-enter data is saved.
(4) As data is not re-entered at each step in the process, therefore labour costs are reduced.
(5) As time delays are reduced therefore more certainty in information flow is there.
(6) EDI generates functional acknowledgement that the EDI message has been received by the recipient and is electronically transferred to sender. Therefore this acknowledgement which is sent electronically by the recipient to sender, states that the message has been received.