COVENANT UNIVERSITY
NIGERIA

TUTORIAL KIT
OMEGA SEMESTER

PROGRAMME: BUILDING TECHNOLOGY

COURSE: BLD 527

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BLD 527: OPERATIONS RESEARCH

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Question1 Describe procedures involved in application of Operations research in research work. 7 Marks

Question 2 List and explain model categorization systems and their subdivision in operations research. 10 Marks.

Question 3 Itemize at least eight research areas in operations research 8Marks

Question 4 List and explain four Limitations of Linear programming. 8 Marks

Question 5 Describe with examples factors to consider in replacement decision analysis. 10 Marks.

Question 6 Enumerate at least seven areas of application of operations research with relevant examples. 7Marks.

i.

Question 7 What are the requirements for deploying Linear programming in solving decision problem? 5 Marks

Question 8 Consider the table of failed electric bulbs below and use it to answer the questions that follows, if 1000 Electric bulbs were used in servicing luminaries in an organization.

Month	1	2	3	4	5
Cumulative proportion of failed bulbs in each month	10	25	50	80	100

i. Calculate the average life span of an electric bulbs used

Question 9 Proportion of Failure During the Period
Probability

(a) Month		
1	**10**	**0.1 0/100= 0.01**
2	**15**	**0.15 /100=0.15**
3	**25**	**0.25 /100=0.25**
4	**30**	**0.3 /100=0.30**
5	**20**	**0.2 /100=0.20**
Total	**100**	**1**

ii. Calculate number of replacement per month.

Average number of replacement per month:

Total bulb in use = 1000

Average life Span of the Bulb 3.35 = 298.65

Question 10 Determine the cost of individual replacement.:

Question 11 State with short description conditions under which scheduling method could be applied. 5 marks

Question 12 Itemize parameters often used to measure prioritization rules effectiveness. 10 Marks

Question 13 Explain the following concept with examples i. Scrap value ii. Residual Value iii. Salvage value. 10 Marks

Question 14 Given the following processing time about six jobs in two machine as follows

Job	Machine I (Hrs)	Machine 2 (Hrs)
P	20	20
Q	16	1
R	33	36
S	8	28

a. Arrange the work into a correct sequence

S	Q	P	R	R	S	P	Q

Machine 1	8	16	20	33
Machine 2	33	28	20	1

Question 15 Using First come First Serve orders develop an optimum sequence for the jobs.

Job	Machine I (Hrs)	Machine 2 (Hrs)
P	20	20
Q	16	1
R	33	36
s	8	28

Question 16 Describe two main methods used to assign jobs to work centers. 25 marks

I. Scheduling
II. Sequencing

ANSWERS

1). Studying past events of operations and determine facts: carefully observing event trends and formulate hypothesis.

Model construction: prepare mathematic al model to explain the proposed theories.

Experimental verification: The facts, theories and then prediction.

2). Models can be classified into two broad categories.

a) Product-based cost model

b) Process-based cost model

Product-based cost model: This type models the finished products. (see also Moore, et al, 1996 and Ferry, 1999). These types of models takes no account of configuration or details of design of the building but is based on certain building parameters. Such parameters are as follow:

i) The floor area of the proposed projects (gross or net).

ii) The volume of the proposed project

iii) Some user's parameters, such as number of pupil places for a school or number of bed for hospital.

Process-based cost model: This is the type of model that deals with construction items process of formation. This is adjudged the most accurate of the models. It is often argued that it is process that actually generates costs; however, the cost cannot be generated until the form of building has been conceptualized. With this, process approach could not be best approach to be adopted at early design stage, since little information would be available for analysis. This view was supported by Moore (1996) that attempt to model construction process at too early stage can result in over-riding of the design process in order to arrive at bricks-and-mortar solution before the user criteria have been properly worked out.

Process -based cost models, can further be classified into sub-types, within the context of probability model and deterministic model or combination of the two. To this end however, the other types of models can be subdivided into two groups, under the previously listed major classifications of models. They are as follows:

Classification based on structure
Model classification based on abstraction.
However, for the purpose of this study, model classification based on abstraction shall be considered.

3). **Queue Problem:** Formulating model that could be used in attending to customer in the line of service. e.g. hospital ward allocation of counsellors to maternity patients.

i. **Replacement Analysis:** This is a method that helps study the pattern, nature and node through which replaceable items in infrastructure can be changed. e.g lighting accessory, car components e.t.c.

ii. **Transportation problem:** The best cost effective way of transporting goods and services.

iii. **Linear programming:** Formulation of optimum replacement strategies that reduces cost. Cost model, Time model, Burnt
Chart model, Earn Value model can be formed though LP.

iv. **Heuristics Algorithm:** Locating an economic way of simplifying complex situation to achievable small tasks.

v. **Network Analysis:** Useful in capital intensive and design compact projects like building, bridges, road works etc.

vi. **Assignment Problem:** This is a linear programming approach to assigning cost, time, and labor resources in a way that would be cost effective.

4). **Assumption of certainty**: uncertainty surrounding cost business situation are not included.

Assumption of linearity: Capable of being approximated by linear function. Objective function and the constraints must all be linear.

Assumption of Continuity: It is assumed that functions are continuous variable.

Single Objectives: An L.P. formulation can only pursue one objective at a time, whereas a practical problem may have multiple objectives.

5). **Repair and Maintenance Cost:** Running cost and maintenance cost of an asset increases with the age of the asset.

Purchase Cost of a New Asset: Replacement cost is often bearable than the purchase cost of new asset.

Opportunity Cost: Negligence-cost incurred on account of non-replacement of part or whole of asset as at when due.

Scrap Value the Asset: Scrap value decreases as an asset age increases.

6). Replacement Analysis ii. Transportation problem iii. Linear programming iv. Heuristics Algorithm. V. Network Analysis: Useful in capital intensive and design compact projects like building, bridges, road works etc.

vi. Assignment Problem.

7). Linear programming can be used to solve problems which possess the following characteristics:

i. Can be stated in numeric terms.
ii. All factors have linear relationships, e.g 6 units follows 12 units and 24 units in logical sequence.
iii. The problem must allow for choice of alternative course of action.
iv. There may be one or more restrictions on the factors involved. There may be restrictions on the availability of resources e.g. only 4000 machine hours are available per week, e.g NPK 15:15:15
feasible practical solution.

8).

Expected or average lifespan of an electric bulb is in the table below: Average life span here is 3.35 months.

Xi	Probability(Pi)	Xi Pi
1	**0.1**	**0.1**
2	**0.15**	**0.3**
3	**0.25**	**0.75**
4	**0.3**	**1.2**
5	**0.2**	**1**
Total	**1.0**	**3.35**

9.

(a) Month		
1	10	0.1 0/100= 0.01
2	15	0.15 /100=0.15
3	25	0.25 /100=0.25
4	30	0.3 /100=0.30
5	20	0.2 /100=0.20
Total	100	1

Average number of replacement per month:

Total bulb in use = 1000

Average life Span of the Bulb 3.35 = 298.65

10. Cost of Individual replacement on failure = Average number of monthly replacement x cost of individual replacement on failure = 298.65 x 40 = N11,946.00 20 Marks

11. Flow Shop: This is high volume system that uses highly standardized equipment to ensure continuous flow of standardized products .e.g. refineries, Cement Company, drinks production.

Job Shop: This is a low volume system, which periodically shift from one job to another. The production is often according to consumers' specification and orders are in small units.

12. There are two conditions under which scheduling could be applied:

i. First come First Serve (FCFS): Processing job in the order of arrivals at work center.

ii. Shortest Processing Time (SPT): Job are processed based base on length of processing time.

iii. Earliest Due Date (EDD): This rule sequences jobs according to their due date. Shortest due date are processed first.

i. 16. Scheduling: The choice of scheduling technique often depends on complexity, desired output and volume of system at hand. There are two conditions under which scheduling could be applied: workshop and flow shop.

ii. Sequencing is about methodical approach to processing loading jobs at work station. It describes the order in which jobs are processed or should be processed at work centers. The widely acceptable rules are of prioritization includes:
First come First Serve (FCFS): Processing job in the order of arrivals at work center.
Shortest Processing Time (SPT): Job are processed based base on length of processing time.
Earliest Due Date (EDD): This rule sequences jobs according to their due date. Shortest due date are processed