KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks scored:

Level : B.E.
Year : III

Course : MEEG 308
Semester: II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

SECTION "A"
[20Q. × 0.5 = 10 marks]

**Mark [× ] in the most appropriate answer box.**

1. In a time-series forecasting model, the demand for five time periods was 10, 13, 15 18 and 22. A linear regression fit results in as equation F = 6.9 + 2.9 t where F is the forecast for period t. The sum of absolute deviation for the five data is?

[ ] 2.9 [ ] 2.2 [ ] 3.2 [ ] 3.9

2. Demand for a certain item has been as shown below:
The forecast for April was 100 units with a smoothing constant of 0.20 and using first order exponential smoothing what is the July forecast?

| Time | Actual Demand |
|---|---|
| April | 200 |
| May | 50 |
| June | 150 |

[ ] 175 [ ] 205 [ ] 250 [ ] 115

3. Given T = Underlying trend, C = Cyclic variations within the trend, S = Seasonal variation within the trend and R = Residual, remaining or random variation, as per the time series analysis of sales forecasting, the demand will be a function of:

[ ] T and C [ ] R and S [ ] T, C and S [ ] T, C, S and R

4. Match List-I with List-II and select the correct answer using the code given below the lists:

| List-I (Term) | | List-II (Characteristics) |
|---|---|---|
| A. | Dummy activity | 1. Follows β distribution |
| B. | Critical path | 2. It is built on activity oriented diagram |
| C. | PERT activity | 3. Constructed only to establish sequence |
| D. | Critical path method | 4. Has zero total slack |

| Codes: | A | B | C | D | | A | B | C | D |
|---|---|---|---|---|---|---|---|---|---|
| [ ] | 3 | 4 | 1 | 2 | [ ] | 4 | 2 | 3 | 1 |
| [ ] | 3 | 4 | 2 | 1 | [ ] | 4 | 2 | 1 | 3 |

5. A work-center operates 6 days per week on a two-shift per day basis (8 hours per shift) and has four machines with the same capability. If the machines are utilized 75 percent of the time at a system efficiency of 90%, what is the rated output in the standard hours per week?

[ ] 216 Standard hr/week
[ ] 236 Standard hr/week
[ ] 270 Standard hr/week
[ ] 259 Standard hr/week

6. A manufacturing shop processes sheet metal jobs, wherein each job must pass through two machines (M1 and M2 in an order) the processing time in hours for these jobs is; Determine the job sequence using Johnson Bellman Rule:

| Machines | Jobs | | | | | |
|---|---|---|---|---|---|---|
| | P | Q | R | S | T | U |
| M1 | 15 | 32 | 8 | 27 | 11 | 16 |
| M2 | 6 | 19 | 13 | 20 | 14 | 7 |

[ ] UTSRQP [ ] UTRSQP [ ] RTSQUP [ ] RTSUQP

7. Profit Volume Charts techniques is an effective tool of application for analyze is when company is dealing with

[ ] A loss situation
[ ] Only turnkey assignments
[ ] More than one products
[ ] One product only

8. If T is the duration, ES and EF are the earliest start and finish time, LS and LF are latest start and finish times, then the following relation holds good

[ ] EF = ES + T [ ] LS = LF – T [ ] LF = ES - T [ ] All of the above

9. Which of the following statements about ABC analysis is false?

[ ] ABC analysis is based on presumption that controlling the few most important items produces the vast majority of inventory savings.
[ ] In ABC analysis "A" items are tightly controlled, have accurate records, and receive regular review by major decision makers.
[ ] In ABC analysis "c" items minimal records, periodic review, and single control
[ ] ABC analysis is based on the presumption that all item must be tightly controlled to produce important cost savings.

10. Which of the following statements about the basic EOQ model is true?

[ ] If ordering cost were to double, the EOQ would rise
[ ] If annual demand were to double, the EOQ would rise
[ ] If the carrying cost were to increase, the EOQ would fall
[ ] All of the above statements are true

11. Relevant criteria in determining whether to outsource (make or buy) decision include:

[ ] Location
[ ] Quality
[ ] Current in-house capacity
[ ] All of the above

12. In a CPM network, computing the critical path requires

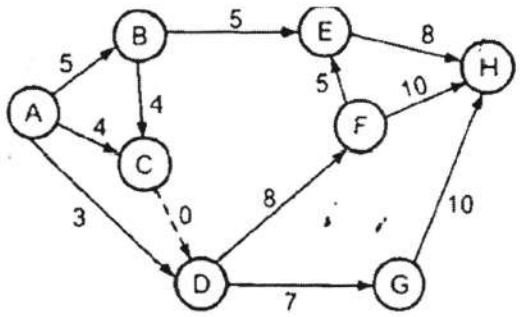
[ ] determining the total project duration
[ ] assigning the earliest finish time for an activity as the earliest start time for the next
[ ] that the latest finishing time for an activity not delay the overall project beyond initial expectation
[ ] a sophisticated and complex computer program

13. Which of the following actions would be best if a firm faced highly seasonal demand for a perishable (sensible to damage) product?
[ ] Hire and fire employees as demand fluctuates.
[ ] Build up inventory when demand is low.
[ ] Add warehouse and production building space to accommodate the highest period of demand.
[ ] Offer a product with a complementary demand pattern.

14. Dispatching
[ ] Prescribes the sequence of operations to be followed
[ ] Determines the program for the operations.
[ ] Is concerned with the starting of the process
[ ] Regulates the progress of the job through various process.

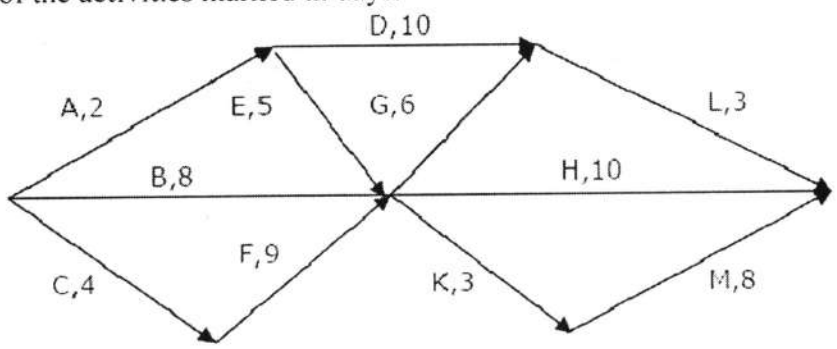
15. The correct sequence of operations in production planning and control
[ ] Routing –Scheduling – Dispatching – Follow up
[ ] Scheduling – Routing – Dispatching _ Follow up
[ ] Dispatching – Routing – Scheduling – Follow up
[ ] Routing – Scheduling - Follow up – Dispatching

16. For the network shown in the given figure, the earliest expected completion time of the project is:




[ ] 26 days [ ] 27 days [ ] 30 days [ ] Indeterminable

17. A Project consists of activities A to M shown in the net in the following figure with the duration of the activities marked in days.




The project can be completed:
[ ] Between 18, 19 days
[ ] Between 24, 26 days
[ ] Between 20,22 days
[ ] Between 60, 70 days

18. Assertion (A): A larger margin of safety in breakeven analysis is helpful in management decision.
Reason (R): If the margin of Safety is large, it would indicate that there will be profit even when there is a serious drop in Production.
[ ] Both A and R are individually true and R is the correct explanation of A
[ ] Both A and R are individually true and R is the not the correct explanation of A
[ ] A is true but R is false
[ ] A is false but R is true

19. A metal processing firm wishes to install enough automatic molders to produce 250,000 good castings per year. The molding operation takes 1.5 minutes per casting, but its output is typically about 3 percent defective. How many molders will be required if each one is available for 2,000 hours (of capacity) per year?
[ ] 3 units [ ] 4 units [ ] 5 units [ ] 6 units

20. A manufacturer has the following data regarding a product,
Fixed cost per month =Rs. 50,000
Variable cost per unit = Rs 200
Selling price per unit = Rs. 300
Production capacity = 1500 units per month
If the production is carried out at 80% of the rated capacity, then the monthly profit is:

[ ] Rs. 56,000- 60,000
[ ] Rs. 40,000-45,000
[ ] Rs. 68,000- 72,000
[ ] Rs. 48,000-54,000

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SECTION "B"

**Attempt ALL questions. Assume suitable data if necessary.**

1.

a. Explain the importance of Industrial Engineering in the evolution in the field of Engineering and its impact in Society. [2]

b. Explain in detail about the interrelationship in Production Planning and Control. [3]

2.

a. Define Production System and explain how the Production System Lifecycle Approach is taken into considerations. [3]

b. Explain Economic Analysis of New Products using, Profit – Volume considerations for multiple management choice cases with suitable numerical example. [4]

3.

a. How would you go about making short and long range forecasts if this were your job in:
   i) A large public utility supplying electricity to a large urban center and the surrounding suburban and rural areas.
   ii) A major automobile company
   iii) A parts making division of the above automobile company
   iv) A medium sized company manufacturing machine tools
   v) A major commercial Airliner

   Articulate with proper reasons of Forecasting methods in precise and short manner. [3]

b. Sundar Balakrishnan , the General Manager if Precision Engineering Corporation, thinks that his firms engineering services contracted to highway constructions business contracted with companies in his geographic area. He wonders if this is really so, and if it is, can this information help him plan his operations better by forecasting the quantity of his engineering services required by construction firms in each quarter of the year? The following table presents the sales of his services and total amounts of contracts for highway construction over the past 8 quarters:

   i) Using this data, develop a regression equation for predicting the level of demand of Precisions Services.
   ii) Determine the coefficient of correlation and Standard Error of the Estimate. [4]

| Quarter | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Sales of PEC Services (in dollars) (thousands) | 8 | 10 | 15 | 9 | 12 | 13 | 12 | 16 |
| Contracts Released (in dollars) (thousands) | 153 | 172 | 197 | 178 | 185 | 199 | 205 | 226 |

4.

a. A chair manufacturer who produces three different models A, B and C has developed a master schedule for the coming five weeks, historically worker productivity has averaged 8 units/week/employee based on the typical mix of chairs. The company employs 50 workers. The standard labor hours for chairs are 1, 2 and 1.5 hours for models A, B and C respectively. Evaluate the capacity utilization of the master production schedule. [3]

| | Master Production Schedule (in Units) | | | | |
|---|---|---|---|---|---|
| | Week | | | | |
| Chair | 1 | 2 | 3 | 4 | 5 |
| A | 200 | 0 | 200 | 0 | 100 |
| B | 0 | 0 | 0 | 200 | 100 |
| C | 100 | 300 | 100 | 0 | |

b. The following capacity Bills are given for item A and B: [3]

| Work Center | Item A | Item B |
|---|---|---|
| 100 | 0.14 hours | 0.07 hours |
| 200 | 0.82 hours | 0.71 hours |
| 300 | 1.16 hours | 0.88 hours |

i) In week 1 there is Master schedule of item A is 60 and Item B is 70. Similarly, in Week 2 Master schedule of item A is 50 and Item B is 90. What are the capacity requirement for each work center for week 1 and 2?

ii) If each work center has stated capacity of 120 standard hours available per week, what actions need to be taken (if any)?

5.

a. A manufacturer carries stock of an item with an annual demand of 25,000 units. Although the inventory manager cannot estimate setup cost or holding cost precisely, he feels that the ratio of the two is somewhere between 80 to 1 and 120 to 1; that is, S/h = 80 to S/h = 120. [4]

i) Calculate EOQ on both conditions.

ii) How sensitive is the optimal Q to the S/h ratio? If S/h doubles or Triples, what happens to Q*?

iii) How sensitive is Q to annual demand? If annual demand doubles or triples, what happens to Q*?

b. A manufacturer requires 4,000 kg of raw materials annually. The ordering cost is Rs. 5 per order. The carrying cost is estimated to be 8% of average inventory per year. The purchase price of the raw material is Rs. 2 per kg. Find the Economic Lot Size and the total cost. The manufacturer is offered a 5% discount in purchase price for order of 800 kg. or more but less than 2000 kg. a further 2% discount is available for order of 2000 kg. or more. Which of the three ways of purchase he should adopt? [3]

6.

a. A machine operator has to perform three operations, on a number of different jobs. There are five jobs, which are to be processed on three machines A, B, C and Din the order ABCD. The processing times in hours for the jobs are given below. Find the optimum sequence and total elapsed time using Johnson Bellman Rule. [4]

| Jobs/machines | A | B | C | D |
|---|---|---|---|---|
| J1 | 11 | 4 | 6 | 15 |
| J2 | 13 | 3 | 7 | 8 |
| J3 | 9 | 5 | 5 | 13 |
| J4 | 16 | 2 | 8 | 9 |
| J5 | 17 | 6 | 4 | 11 |

b. Determine [4]

i) Draw the CPM network; analyze the paths through the network.

ii) Determine the Total Float, Free Float for each activity, find the critical path.

iii) Find the project completion time.

| Activity | 1-2 | 1-3 | 1-4 | 2-6 | 3-7 | 3-5 | 4-5 | 5-9 | 6-8 | 7-8 | 8-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Duration (in days) | 2 | 2 | 1 | 4 | 5 | 8 | 3 | 5 | 1 | 4 | 3 |

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SECTION "A"
[10Q × 0.5 = 5 marks]

Fill in the blank space(s) by selecting the most appropriate answer from among the given ones. (*Do not tick the answer*).

1. If $a, b \in \mathbb{Z}$ and $b \neq 0$, then $\exists$ a unique pair of integer $q$ and $r$, such that $a = bq + r$ where _____.

   a. $0 \leq r \leq |b|$ b. $0 \leq r < |b|$ c. $0 > r > |b|$ d. $0 \leq r \leq b$

2. If $a$ and $b$ are two integers, then $\exists$ some integer $x$ and $y$ such that _____.

   a. $\gcd(a, b) = ax + by$ b. $\gcd(a, b) = ax - by$
   c. $\gcd(a, b) = ax^n + by^n$ d. $\gcd(a, b) = (ax + by)^n$

3. Which of the following Diophantine equations has no solution in integers? _____ _____.

   a. $3x + 7y = 10$ b. $8x - 12y = 5$ c. $6x + 12y = 96$ d. $5x + 10y = 25$

4. Congruence is not _____ .

   a. Symmetric b. Reflexive c. Transitive d. Anti –symmetric

5. If $a|c, b|c$ and $(a, b) = 1$ then _____ .

   a. $ab|c$ b. $bc|a$ c. $a|bc$ d. $c|ab$

6. Which name matches statement if $a|bc$ and $(a, b) = 1$ then $a|c$ _____.

   a. Euclid's Lemma b. Fermat's Theorem
   c. Division Algorithm d. Euclidean Algorithm

7. Every integer $n$ is a product of prime such that _____.

   a. $n > 1$ b. $n > 2$ c. $n < 1$ d. $n > 0$

8. Which of the following is the valid solution to the congruence $2x \equiv 1(mod5)$? _____.

   a. $x \equiv 3(mod5)$ b. $x \equiv 1(mod5)$ c. $x \equiv 5(mod5)$ d. $x \equiv 4(mod5)$

9. Which theorem states that if $p$ is a prime, then $(p-1)! \equiv -1(modp)$ _____.

   a. Euler's Theorem b. Wilson's Theorem
   c. Fermat's Little Theorem d. Dirichlet's Theorem

10. The order of 2 modulo 7 is _____.

    a. 1 b. 3 c. 2 d. 4

## SECTION "B"

[10 Q. × 0.5 = 5 marks]

Fill in the blank space(s) by writing the most appropriate word(s) or symbol(s).

11. Two integers $a$ and $b$ that are not congruent to each other with respect to $mod(m)$ are said to be _____.

12. Let $d = \gcd(a, b)$ and $n \in \mathbb{N}$. If $d|c$ and $(x_0, y_0)$ is a solution of Diophantine equation $ax + by = c$, then all the integers solution is given by _____ _____.

13. Let $m$ be a positive integer, two integers $a$ and $b$ are congruence modulo $m$ if and only if _____.

14. The number of mutually incongruent solution of linear congruent $42x \equiv 90(mod156)$ is _____.

15. Euler phi- function of a prime number $p$ is $\varphi(p) =$ _____.

16. For a positive integers $n$, defined $\mu$ by the rules $\mu(n) =$ _____ if $n = p_1p_2 \dots p_r$, where $p_i$ are distinct primes.

17. A number-theoretic function $f$ is said to be multiplicative if _____, whenever $\gcd(m, n) = 1$.

18. $\varphi(100) =$_____, where the symbol has its usual meaning.

19. The number of Pseudoprimes is infinitely many. The smallest one Pseudoprime being __ _____.

20. The number of primitive roots of integer 17 is _____.