

May 2022 (ENDSEM) EXAM
T.Y. (SEMESTER - II)
COURSE NAME: OPERATION RESEARCH
COURSE CODE: ES32184ME
(PATTERN 2018)
Solution and Marking Scheme

Q.1	a) Table : 3 + Ans:1		[4]																																							
	<table><tr><td>Cost of Machine</td><td>100000</td></tr><tr><td>Scrap Value</td><td>20000</td></tr></table> <table><tr><th>Year</th><th>Maintenance Cost</th><th>Cumulative Maintenance Cost</th><th>Total Cost</th><th>Annualized Total Cost</th></tr><tr><td>1</td><td>10000</td><td>10000</td><td>90000</td><td>90000</td></tr><tr><td>2</td><td>20000</td><td>30000</td><td>110000</td><td>55000</td></tr><tr><td>3</td><td>30000</td><td>60000</td><td>140000</td><td>46667</td></tr><tr><td>4</td><td>40000</td><td>100000</td><td>180000</td><td>45000</td></tr><tr><td>5</td><td>50000</td><td>150000</td><td>230000</td><td>46000</td></tr><tr><td>6</td><td>60000</td><td>210000</td><td>290000</td><td>48333</td></tr></table>	Cost of Machine	100000	Scrap Value	20000	Year	Maintenance Cost	Cumulative Maintenance Cost	Total Cost	Annualized Total Cost	1	10000	10000	90000	90000	2	20000	30000	110000	55000	3	30000	60000	140000	46667	4	40000	100000	180000	45000	5	50000	150000	230000	46000	6	60000	210000	290000	48333		
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	b) EOQ: 2;CI:2; TC= 2 D=1000 per year Cp=25000 per unit Co=5000 CI=1000 $EOQ = Q_o = \sqrt{\frac{2DC_o}{C_H}} = 100$ $C_l = \sqrt{2DC_oC_H} = 100000$ Total optimum cost = 25000*1000+100000 = 25100000		[6]																																							
	OR																																									
	b) EOQ: 4; Tmfg: 2 D=30 per day P = 50 per day Cp=- Co=100000 Ch=5000 per year = 13.7 per day $EOQ = Q_o = \sqrt{\frac{2DC_o}{C_H \left(1 - \frac{D}{P}\right)}} = 1046$ $T_{mfg} = \frac{Q_o}{P} = 21 \text{ Days}$		[6]																																							
Q.2	a) Rho = 2; P = 2		[4]																																							

$$\lambda = 1/20 \quad \mu = 1/10$$

$$\rho = \lambda / \mu = 1/2$$

$$P(n < 3) = 1 - \rho^3 = 1 - (1/2)^3 = \underline{\underline{0.875}}$$

b) Derivation: 4; Ans: 2

[6]

$\lambda = \frac{1}{20}$ $\mu = \frac{1}{10}$ find μ_{new} ?

$w_q = 5$

$$w_q' = \frac{L_q'}{\lambda'} = \frac{L_s' - \rho'}{\lambda'} = \frac{\frac{\rho'}{1-\rho'} - \rho'}{\lambda'}$$

$$w_q' = \frac{\frac{\lambda'}{\mu'} - \frac{\lambda'}{\mu'}}{1 - \frac{\lambda'}{\mu'}} = \frac{\lambda' \left(\frac{1}{\mu'} - \frac{1}{\mu} \right)}{\lambda'}$$

$$w_q' = \frac{1}{\mu' - \lambda} - \frac{1}{\mu'}$$

$$w_q' = \frac{\mu'^2 - \mu'^2 + \lambda}{\mu'(\mu' - \lambda)}$$

$$5 = \frac{1/20}{(\mu')^2 - (\mu') \cdot 1/20}$$

$$5(\mu')^2 - 5 \times \frac{1}{20}(\mu') - \frac{1}{20} = 0$$

$\mu' = 0.128$ /min or 1 student / 7.81 minute

Service time = 7.81 minutes per student

OR

b) Seq: 2; Table: 2; Ans: 2

[6]

Job Sequence Chart						
Sequence	I	II	III	IV	V	VI
Plant	J6	J4	J1	J2	J5	J3

Job No.	M/C A			M/C B		
	In	Out	Idle	In	Out	Idle
J6	0	12	0	12	35	12
J4	12	26	0	35	53	0
J1	26	42	0	53	70	0
J2	42	62	0	70	96	0
J5	62	89	0	96	120	0
J3	89	114	27	120	141	0
Total			27			12

Q.3 a) Correctness: 2; Rules followed: 1; Naming numbering, arrows: 1

[4]

b) Network diagram: 2 Critical path: 2 Time calculations: 2

[6]

ID	Task Name	Predecessors (Enter one ID per cell)	O (min)	M (most likely)	P (max)	Duration (exp. time)	ES	EF	LS	LF	Slack
9	Start					0.00	0.00	0.00	0.00	0.00	0.00
10	A	9	2	2	2	2.00	0.00	2.00	7.00	9.00	7.00
11	B	9	8	8	8	8.00	0.00	8.00	0.00	8.00	0.00
12	C	10	8	8	8	8.00	2.00	10.00	9.00	17.00	7.00
13	D	11	9	9	9	9.00	8.00	17.00	8.00	17.00	0.00
14	E	12 13	12	12	12	12.00	17.00	29.00	17.00	29.00	0.00
15	F	12 13	4	4	4	4.00	17.00	21.00	26.00	30.00	9.00
16	G	14	6	6	6	6.00	29.00	35.00	29.00	35.00	0.00
17	H	15	5	5	5	5.00	21.00	26.00	30.00	35.00	9.00

OR

b) Te and Var: 2; CP: 2; Probability: 2

[6]

Activity	Time (Optimistic)	Time (Most likely)	Time (Pessimistic)	Time (Expected)	Variance
1 - 2	6	9	12	9	1
2 - 3	14	17	20	17	1
2 - 4	7	10	13	10	1
2 - 5	12	15	18	15	1
3 - 5	2	5	14	6	4
4 - 5	3	6	15	7	4
5 - 6	1	10	19	10	9

T 34.00
 STD. DEV. 3.87
 TCP 42.00
 Z -2.07
 Value from Z table 0.4808
 % Probability 1.92%