BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

ME F316: MANUFACTURING MANAGEMENT

Mid Semester Examination: Closed Book

Max Marks: 50 **Duration: 90 minutes** **Date: 13/10/2023**

Note: Be precise and correct. Marks will not be awarded for any incorrect intermediate calculation and onwards.

Q1.

i) If the failure rate of a component is 6.67 x 10^{-5} failures/hr, calculate each component's reliability for a period of 1000 hours. What will be the system's reliability with the 4 components having the same calculated reliability, if used in a 3-out-of-4 configuration? **[4]**

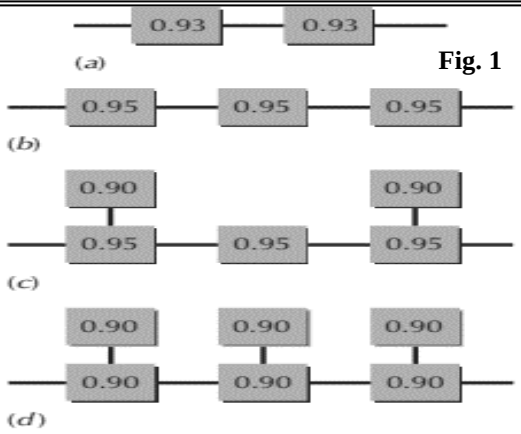


Fig. 1

ii) Examine the given systems (Fig. 1) and comment on which system is more reliable, a, b, c or d? If it costs \$1000 for each 90% reliable component, \$1500 for each 93% reliable component, \$2000 for each 95% reliable component, and \$10,000 to repair a failed system, which system would you choose, a, b, c or d? **[6]**

iii) Merrimac Manufacturing Company has always purchased a certain component part from a supplier on the East Coast for \$50 per part. The supplier is reliable and has maintained the same price structure for years. Recently, improvements in operations and reduced product demand have cleared up some capacity in Merrimac's own plant for producing component parts. The particular part in question could be produced at \$40 per part, with an annual fixed investment of \$25,000. Currently, Merrimac needs 300 of these parts per year.

(a) Should Merrimac make or buy the component part?

(b) As another alternative, a new supplier located nearby is offering volume discounts for new customers of \$50 per part for the first 100 parts ordered and \$45 per part for each additional unit ordered. Should Merrimac make the component in-house, buy it from the new supplier, or stick with the old supplier?

(c) Would your decision change if Merrimac's annual demand increased to 2000 parts? increased to 5000 parts?

(d) Develop a set of rules that Merrimac can use to decide when to make this component, when to buy it from the old supplier, or when to buy it from the new supplier. **[6]**

Q2.

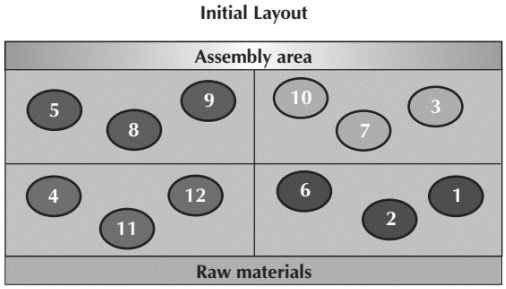
i) Tech Express provides technical assistance to customers through six separate departments. While much of the communication is electronic, it is helpful for departments working together on a customer's request to be physically located near to each other. Given the following data on customer "flow" between departments, design a layout on a 2×3 grid that will facilitate the maximum collaboration among departments. How much customer flow is nonadjacent? **[6]**

	Customer Flow To					
From	1	2	3	4	5	6
1	—	50	100	25	60	
2	40	—	80		150	
3	10	70	—	55		
4	10		80	—		
5	40			80	—	30
6		60	50			—

ii) Jetaway, a small manufacturer of replacement parts for the aircraft industry, had always maintained a simple layout—all like machines were located together. That way the firm could be as flexible as possible in producing small amounts of the variety of parts its customers required. No one questioned the production arrangement until Chris Munnelly started to work for the company. Chris was actually hired to upgrade Jetaway's computer system. In the process of creating a database of part routings, Chris began to see similarities in the parts produced. A part routing matrix for nine of the most popular parts is shown below, along with a schematic of the factory layout.

Chris, who was already tired of being a programmer, decided to reorder the matrix and see what he could find. If he could identify distinct part families, he could reorganize the placement of machines into the cells he had been reading about in his business magazines. Maybe then someone would notice his management potential. Help Chris gain status in Jetaway by creating a cellular layout for the company. Show your results in a schematic diagram. Be sure to include the reordered routing matrix. **[6]**

Parts	Machines 1	2	3	4	5	6	7	8	9	10	11	12
A	×			×	×							
B		×	×			×						
C								×			×	
D	×			×	×		×					
E		×	×			×			×			×
F								×		×	×	
G	×				×		×					
H		×	×			×			×			
I								×		×		



iii) Best Vision is revamping its assembly lines to improve efficiency. As shown below, there are 10 steps to assembling a television set.

(a) If Best needs to produce 120 televisions in a 40-hour work week, how should the line be balanced? Given that one worker is assigned to each workstation, how many workers are required to operate the line? What is the efficiency of the line?

(b) If demand for televisions is reduced to 100 sets per 40-hour week, how many workers will be needed to man the line? Re-balance the line and re-calculate its efficiency. **[8]**

Task	Precedence	Time (min)
A	None	8
B	A	4
C	A	7
D	A	3
E	B	7
F	C, E	11
G	D	2
H	G	8
I	F, H	5
J	I	7

Q3.

i) The Oceanside Hotel is adjacent to City Coliseum, a 24,000-seat arena that is home to the city's professional basketball and ice hockey teams and that hosts a variety of concerts, trade shows, and conventions throughout the year. The hotel has experienced the given occupancy rates for the nine years since the coliseum opened. Compute an exponential smoothing forecast with a $\alpha = 0.20$, an adjusted exponential smoothing forecast with a $\alpha = 0.20$ and $\beta = 0.20$, and a linear trend line forecast. Compare the three forecasts using MAD and average error ($\bar{E}$), and indicate which forecast seems to be most accurate. **[8]**

Year	Occupancy Rate, %
1	75
2	70
3	72
4	77
5	83
6	81
7	86
8	91
9	87

ii) Temco Industries has developed a forecasting model that was used to forecast during a seven-month period. The forecasts and actual demand are shown in the table. Monitor the forecast for bias using a tracking signal and a control chart with ±3 MAD. Does there appear to be any bias in the forecast? **[6]**

Month	Actual Demand	Forecast Demand
1	160	170
2	150	165
3	175	157
4	200	166
5	190	183
6	220	186
7	205	203

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