Question 1

A 28 station transfer line operates with an ideal cycle time of 1.5 min. The probability of failure at any station is 0.015, and the average down time per stop is 10.0 min. The line is to be divided into two stages by installing buffer between stations 10 and 11. The cost of installing the storage buffer is equal 0.04b SR/min, where b = the buffer capacity. This buffer is constructed to store increment of (5). The cost to operate the line is 600 SR/hr. Ignoring the material and tooling costs, determine the buffer capacity (b) that will minimize unit product cost.

Question 2

A part is to be produced on an automated transfer line with process time of (40/n) min, where n = the number of work stations. The transfer time between stations is 0.1 min. If the probability of breakdown at any station is 0.01 and the average downtime per breakdown is 10.0 min.

(i) Using upper bound approach, find the number of stations which maximize the production rate.
(ii) Find the production rate and line efficiency for this number of stations.

Question 3

A 30 station transfer line operates with an ideal cycle time of 1.6 min. The probability of failure at any station is 0.02, and the average down time per stop is 10.0 min. The line is to be divided into two stages by installing buffer between stations 15 and 16. The cost of installing the storage buffer is equal 0.06b SR/min, where b = the buffer capacity. This buffer is constructed to store increment of (10). The cost to operate the line is 700 SR/hr. Ignoring the material and tooling costs, determine the buffer capacity (b) that will minimize unit product cost.

Question 4

A part is to be produced on an automated transfer line with process time of (60/n) min, where n = the number of work stations. The transfer time between stations is 0.25 min. If the probability of breakdown at any station is 0.01 and the average downtime per breakdown is 10.0 min.

(i) Using upper bound approach, find the number of stations which maximize the production rate.
(ii) Find the production rate and line efficiency for this number of stations.

Question 5

20 station transrer line performs processing operations for two weeks.The failure propability of each station=0.006, cycle time =1.2 min, and average down time =10 min. Solve the following:-

i- For cases below, **find** (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts.
  a. No parts are removed when the line jam
  b. Parts are removed when the line jam
  c. Parts are removed for 25% of the breakdown occurrence

ii- When the line is divided to two stages with buffer, **find** the proper buffer size

Question 6

Nine stations transfer line performance is observed during a period at which 3000 parts are completed. The observations are recorded in Table (1).

(i) Determine for upper and lower bounds the production rate and the line efficiency.

(ii) Select a place for a buffer storage between the stations and find:

- line efficiency for infinite buffer size
- line efficiency for a buffer size (10).

Table (1)

Station	Processing time, min	Break downs
1	0.5	0
2	0.8	30
3	1.0	45
4	0.6	55
5	0.8	20
6	0.9	70
7	0.5	100
8	0.6	80
9	0.9	0
Transfer time = 0.2 min. Average repair time = 50 min.		

Question 7

16 station flow line performs processing operations for four weeks. The line behaves according data given in table (1). The tranfer time is 0.3 minute and average downtime is 10 minute.

A) Find failure and repair rate of stations.

B) **Find** (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts. For the following:-
   a. Upper Bound
   b. Lower bound
   c. 30% of the breakdown occurance is of lower bound

C) Find the optimum number of the infinite buffers, andLine efficiency.

D) The line is to be divided into two stages by installing buffer between stations 10 and 11. The cost of installing the storage buffer is equal 0.04b SR/min, where b = the buffer capacity. This buffer is constructed to store increment of (20). The cost to operate the line is 600 SR/hr. Ignoring the material and tooling costs, determine the buffer capacity (b) that will minimize unit product cost.

TABLE (1)

station	Process time, min	Breakdown
1	0.5	0
2	0.9	50
3	1.2	40
4	0.8	30
5	1.2	25
6	0.9	35
7	0.7	40
8	0.6	20

Station	Process time, min	Breakdown
9	1.2	25
10	0.7	40
11	1.2	20
12	1.1	35
13	0.9	25
14	1.2	45
15	0.9	50
16	1.2	0

Question 8

16 station flow line performs processing operations for four weeks. The line behaves according data given in table (1). The tranfer time 0.2 min.

a) Find failure and repair rate of station

b) **Find** (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts. For the following:-
   a. Upper Bound
   b. Lower bound
   c. 30% of the breakdown occurance is of lower bound

c) Find the optimum number of the infinite buffers, andLine efficiency.

TABLE (1)

station	Process time, min	Breakdown
1	0.5	0
2	0.9	25
3	1.1	35
4	0.8	45
5	1.2	20
6	0.9	35
7	0.7	40
8	0.6	20

Station	Process time, min	Breakdown
9	0.6	20
10	0.7	45
11	1.2	20
12	1.1	30
13	0.9	40
14	0.8	45
15	0.9	20
16	1.2	0

Question 9

20 station transrer line performs processing operations for two weeks. The line behaves according data given in table (2). Solve the following:-

A) For cases below, **find** (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts.
   a. No parts are removed when the line jam,
   b. Parts are removed when the line jam,
   c. Parts are removed for 25% of the breakdown occurance.

B) When the line is divided to four stages, **find** (1) the proper positions of the infinite buffers, and (2) Line efficiency.

C) When the line is divided to two stages with buffer size 30, **find** (1) the proper positions of the buffer, and (2) Line efficiency.

TABLE (2)

station	Process time, min	Breakdown
1	0.5	0
2	1.1	22
3	0.9	32
4	0.8	46
5	1.2	35
6	0.5	30
7	0.7	55
8	0.9	25
9	1.0	20
10	1.2	15

Station	Process time, min	Breakdown
11	0.6	20
12	0.7	30
13	0.8	28
14	1.2	29
15	0.9	50
16	0.8	45
17	0.9	20
18	1.2	28
19	0.7	30
20	0.5	0

Question 10

A 28-station transfer line operates with an ideal cycle time of 1.5 min. The probability of failure at any station is 0.015, and the average down time per stop is 10.0 min. The line is to be divided into two stages by installing buffer between stations 10 and 11. The cost of installing the storage buffer is equal 0.04b SR/min, where b = the buffer capacity. This buffer is constructed to store increment of (5). The cost to operate the line is 600 SR/hr. Ignoring the material and tooling costs, determine the buffer capacity (b) that will minimize unit product cost.

Question 11

12-station transfer line performs processing operations for two weeks. The line behaves according data given in table (2). Solve the following: -

a. For cases below, <u>find</u> (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts.
   i. No parts are removed when the line jam,
   ii. Parts are removed when the line jam,
   iii. Parts are removed for 35% of the breakdown occurrence.

b. When the line is to be divided to stages, find the optimum number of buffers

TABLE (2)

Station	1	2	3	4	5	6	7	8	9	10	11	12
Process time, min	0.8	1.2	0.9	1.2	0.8	1.0	1.2	0.9	1.1	1.2	0.9	0.8
Breakdown	0	55	50	35	40	30	40	30	35	45	60	0
Transfer time, min	0.25											
Average Downtime, min	6.0											

Question 12

16 station transrer line performs processing operations for two weeks. The line behaves according data given in table (2). Solve the following:-

A) For cases below, **<u>find</u>** (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts.
   a. No parts are removed when the line jam,
   b. Parts are removed when the line jam,
   c. Parts are removed for 30% of the breakdown occurance.

B) When the line is divided to four stages, **<u>find</u>** (1) the proper positions of the infinite buffers, and (2) Line efficiency.

C) When the line is divided to two stages with buffer size 20, **<u>find</u>** (1) the proper positions of the buffer, and (2) Line efficiency.

TABLE (2)

station	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Process time, min	0.5	1.1	0.9	0.8	1.1	0.5	0.7	0.9	0.6	0.7	0.8	1.1	0.9	0.8	0.9	1.1
Breakdown	0	22	32	46	35	30	50	25	24	36	35	40	55	40	20	0
Transfer time, min	0.1															

Question 13

A) Discuss briefly the concepts of the upper and lower boundary approaches.

B) 10-station transfer line performs processing operations for three weeks. The line behaves according data given in table (1). Solve the following: -
   a. Find failure and repair rate of stations.
   b. For cases below, <u>find</u> (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts.
      i) No parts are removed when the line jam,
      ii) Parts are removed when the line jam,
      iii) Parts are removed for 30% of the breakdown occurrence.

TABLE (1)

Station	1	2	3	4	5	6	7	8	9	10
Process Time, min	0.8	1.2	0.9	1.2	0.8	1.0	1.2	0.9	1.1	1.2
Number of Breakdown	55	38	58	45	40	46	51	33	44	50
Average Downtime, min	9.0	12.0	11.0	8.0	10.5	11.5	10.0	14.0	8.5	9.5
Transfer Time, min	0.3									

Question 14

A- i) Discuss briefly the concepts of the upper and lower boundary approaches for transfer line analysis? ii) Why a buffer storage in flow line system is used?

B- Ten stations transfer line performance is observed during a period of two week.The observations are recorded in the table below. Determine:

i) The production rate and the line efficiency when the line behave as: (a) Upper bound, (b) Lower bound, and (c) Only 25% of the line is lower bound.

ii) The efficiency when the line is divided to 2,3 and 4 stages? (Hint: Try for equal frequancy anf process time).

Station	1	2	3	4	5	6	7	8	9	10
Processing time, min	0.5	0.8	1.0	0.8	1.0	0.9	1.0	0.8	1.0	0.5
Break downs	0	50	55	35	70	70	35	55	50	0
Transfer time = 0.2 min.										
Average repair time = 6 min.										

Question 15

For four weeks operation, 8-station transfer line behaves according data given in table (1).

a) Find failure and repair rate of stations.

b) Find (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts, for the case that the line is operating under upper bound 75% and lower bound 25%.

c) Determine the buffer capacity (b) that will minimize unit product cost, if the line is divided into two stages by installing buffer between stations 4 and 5. The cost of installing the storage buffer is equal 0.3b SR/min, where b = the buffer capacity. The cost to operate the line is 600 SR/hr. Ignoring the material and tooling costs. (Buffer increase in increment of 5 units)

TABLE (1)

Station	1	2	3	4	5	6	7	8
Process Time, min	0.9	1.2	0.9	1.2	0.8	1.0	1.2	1.1
Number of Breakdown	50	40	55	45	40	55	50	35
Average Downtime, min	15	15	14	14	16	14	12	17
Transfer Time, min	0.3							

Question 16

14 station transfer line forms the machining operations according the data given in the table (1). For a period of which 2500 parts are produced, the average repair time is 15.0 minutes.

A) Using upper bound approache, determine the following:-

a. MLT
b. Average production rate.
c. Line efficiency.
d. How many hours were required to produce the 2500 parts.

B) If the line is to be divided into two stages, suggest the proper position of the buffer and determine it's size that gives 100% improvement.

Table (1)

Station	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Process Time, Min.	0.6	1.1	1.3	0.8	1.1	0.8	0.8	0.9	1.1	0.7	1.3	0.9	0.8	1.1
Downtime Occurance	0	20	24	27	37	14	28	32	30	28	21	24	15	0
Transfer Time,min.	0.2													

Question 17

14-station transfer line performs processing operations for four weeks. The line behaves according data given in table (1). Solve the following: -

a. Find failure and repair rate of stations.

b. For cases below, find (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts.
   i. No parts are removed when the line jam,
   ii. Parts are removed when the line jam,
   iii. Parts are removed for 35% of the breakdown occurrence.

c. When the line is to be divided to stages, find the number of infinite buffers that will minimize unit product cost if the cost of the buffer is 60 SR/hr and the cost of the operation of the line is 600 SR/hr, ignoring the material and tooling costs.

TABLE (1)

Station	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Process Time, min	1.3	0.8	1.2	0.9	1.2	0.8	1.0	1.2	0.9	1.1	1.2	1.1	1.0	1.3
Number of Breakdown	0	50	37	48	45	53	42	50	34	40	50	47	54	0
Average Downtime, min	0	10	12	11	10	15	13	14	12	12	14	11	10	0
Transfer Time, min	0.3													

Question 18

12-station transfer line performs processing operations for two weeks. The line behaves according data given in table (2).

a) Determine failure and repair rates
b) Determine downtime frequency stop/cycle for upper and lower bounds
c) For Parts are removed for 35% of the breakdown occurrence, find (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, (4) Defect parts, and (5) cost of the product, if the operating cost is equal 40 SR/hr and ignoring other costs.
d) If the line is to be divided to stages, find the number of stages which give minimum cost if the buffer cost is 1500 SR/hr for parts produced during the studied period of production

TABLE (2)

Station	1	2	3	4	5	6	7	8	9	10	11	12
Process time, Tp, min	0.8	1.2	0.9	1.2	0.8	1	1.2	0.9	1.1	1.2	0.9	0.8
Breakdown, N	25	35	45	45	35	25	25	35	45	45	35	25
Average Downtime, Td min	10	8	6	6	8	10	10	8	6	6	8	10
Transfer time, min	0.3											

Question 19

10-station transfer line performs processing operations for four weeks. The line behaves according data given in table below. Solve the following: -

a. Find failure and repair rate of stations.**[6 marks]**

b. For cases below, find (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts.
   i. No parts are removed when the line jam, **[4 marks]**
   ii. Parts are removed when the line jam, **[4 marks]**
   iii. Parts are removed for 35% of the breakdown occurrence. **[4 marks]**

c. When the line is to be divided to stages, find the number of infinite buffers that will minimize unit product cost if the cost of the buffer is 10 SR/hr and the cost of the operation of the line is 60 SR/hr, ignoring the material and tooling costs. **[12 marks]**

Station	1	2	3	4	5	6	7	8	9	10
Process Time, min	1.3	0.8	1.3	0.9	1.3	0.8	1	1.3	0.9	1.3
Number of Breakdown, N	70	50	40	50	45	80	45	80	40	40
Average Downtime, min, MTTR	12	10	12	11	10	15	13	14	12	12
Transfer Time, min	0.3									

Question 20

A) Discuss briefly the concepts of the upper and lower boundary approaches.

B) 10-station transfer line performs processing operations for three weeks. The line behaves according data given in table (1). Solve the following: -

a. Find failure and repair rate of stations.

b. For cases below, find (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts.

iv) No parts are removed when the line jam,

v) Parts are removed when the line jam,

vi) Parts are removed for 30% of the breakdown occurrence.

TABLE (1)

Station	1	2	3	4	5	6	7	8	9	10
Process Time, min	0.8	1.2	0.9	1.2	0.8	1	1.2	0.9	1.1	1.2
MTTF, min	332	386	351	286	420	349	252	298	351	228
MTTR, min	10	14	18	14	16	20	15	22	18	12
Transfer Time, min	0.3									

Question 21

10-station transfer line performs processing operations for four weeks. The line behaves according data given in table below. Solve the following: -

d. Find failure and repair rate of stations

e. For cases below, find (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts.

i. No parts are removed when the line jam,

ii. Parts are removed when the line jam,

iii. Parts are removed for 35% of the breakdown occurrence.

f. When the line is to be divided to stages, find the number of infinite buffers that will minimize unit product cost if the cost of the buffer is 10 SR/hr and the cost of the operation of the line is 60 SR/hr, ignoring the material and tooling costs.

Station	1	2	3	4	5	6	7	8	9	10
Process Time, min	1.3	0.8	1.3	0.9	1.3	0.8	1	1.3	0.9	1.3
Number of Breakdown, N	70	50	40	50	45	80	45	80	40	40
Average Downtime, min, MTTR	12	10	12	11	10	15	13	14	12	12
Transfer Time, min	0.3									

Question 22

a) Discuss briefly the meaning of time dependent failure approach and operational dependent failure approach of flow line?

b) Data of one week is collected for a transfer line is given in the table below. The line consists of three machines (A, B, C) operating with cycle time of 1.0 min. **Determine:**

i. failure and repair rate.

ii. line efficiency and production rate for the case of line operating under 75% operational dependent failure and 25% time dependent failure.

Machine	Number of operating cycles	Number of repair cycles
A	170, 190, 140, 330, 200, 165, 145, 250, 190, 150	48, 40, 35, 60, 52, 38, 45, 56, 52, 44
B	150, 220, 330, 394, 300, 270, 230, 130	45, 45, 35, 60, 58, 42, 50, 41
C	450, 200, 465, 250, 156, 250, 300	52, 46, 55, 50, 40, 42, 44

Question 23

A) Discuss briefly the meaning of of the upper and lower boundary approaches.

B) During one week production line consisting of four machines (A, B, C, D), the operating and repair cycles are obtained as shown in table (1). The line operating with cycle time of 1.0 min. **Determine:**

i. failure and repair rate.

ii. for the case of line operating under 75% operational dependent failure and 25% time

(1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, (4) Defect parts, and (5) cost of the product, if the operating cost is equal 40 SR/hr and ignoring other costs.

Table (1)

Machine	Number of operating cycles	Number of repair cycles
A	170, 190, 140, 330, 200, 165, 145, 250, 190, 150	48, 40, 35, 60, 52, 38, 45, 56, 52, 44
B	150, 220, 330, 394, 300, 270, 230, 130	45, 45, 35, 60, 58, 42, 50, 41
C	450, 200, 460, 250, 155, 250, 300	52, 46, 55, 50, 40, 42, 44
D	220, 250, 240, 220, 280, 260, 210, 167, 130	50, 55, 55, 45, 40, 45, 50, 40, 43

Question 24

One week operation data of a 6-station flow line are given in table (1). *Analyse* the following:-

a. Failure and repair rate of stations.

b. Number of parts completed

c. Frequency of failure per cycle for upper and lower bounds

d. (1) Production rate, (2) Line efficiency, (3) Acceptable number of parts, and (4) Defect parts, for cases below

i. No parts are removed when the line jam,

ii. Parts are removed when the line jam,

iii. Parts are removed for 30% of the breakdown occurrence.

e. When the line is to be divided into two stages, find buffer size (b) that will minimize unit product cost. The cost of installing the storage buffer is equal 0.06b SR/min, where b = the buffer capacity. This buffer is constructed to store increment of (10). The cost to operate the line is 600 SR/hr. Ignoring the material and tooling costs, ignoring the material and tooling costs.

Table (1)

Station	Process Time, Min.	Number of failure	Number of operating cycles	Number of repair cycles
A	0.9	10	170,80,50,525,100,160,375,250,240,150	32,15, 25,55,28,25,35,25,35,25
B	0.8	8	250, 220, 130, 630,350, 160, 250, 200	45,35,15,20,40,17,18,20
C	0.75	7	500, 130, 500, 250, 150, 250, 310	40,50,60,40,35,40,45
D	0.7	12	100,80,90,325,100,160,375,250,240,150,75,155	27,15,25,25,28,25,35,25,20,25,30,20
E	0.85	8	500, 250, 300,325,200,200, 170, 250	35,20,25,25,30,15,25,30
F	0.9	10	100,230,150,325,100,160,375,250,240,150	30,35,25,40,30,25,25,30,35,45
Transfer Ttime, min			0.1	

Question 25

A two-week study is performed on a 10-stations transfer line. The line behaves according data given in table (1). Solve the following: -

a) Find for cases below, (1) Failure and repair rates, (2) Line efficiency, (3) Production rate, (4) Acceptable number of parts, and (5) Defect parts.
   i. No parts are removed when the line jam,
   ii. Parts are removed when the line jam,
   iii. Parts are removed for 25% of the breakdown occurrence.

b) When the line is to be divided to stages, find the optimum number of buffers

TABLE (1)

Station	1	2	3	4	5	6	7	8	9	10
Average Uptime, cycles	250	360	480	300	800	750	960	600	550	320
Average Downtime, cycles	20	30	40	30	60	60	72	60	50	24
Cycle time, min	1.25									

Question 26

A four-week study is performed on a 5-stations transfer line. The line behaves according data given in table (3).

A) Find for cases below, (1) Failure and repair rates, (2) Line efficiency, (3) Production rate, (4) Acceptable number of parts, and (5) Defect parts, (6) cost of the line, if the operating cost is equal 50 SR/hr and ignoring other costs.
   i. Operational dependent failure approach
   ii. Time dependent failure approach
   iii. Time dependent failure occurs 35%

B) If the line is to be divided to stages, find the optimum number of stages if the buffer cost is 3000 SR for parts produced during the studied period of production.

Table (3)

Station	1	2	3	4	5	6	7	8
Number of break down	30	40	25	35	30	40	25	35
Average Downtime time, cycles	10							
Cycle time, min	2							

Question 27

A two-week study is performed on a 5-stations transfer line. The line behaves according data given in table (2). Find for cases below, (1) Failure and repair rates, (2) Line efficiency, (3) Production rate, (4) Acceptable number of parts, and (5) Defect parts.

i. Operational dependent failure approach
ii. Time dependent failure approach
iii. Time dependent failure occurs 35%

Table (2)

Station	1	2	3	4	5
Average Uptime per breakdown, cycles	200	320	267	160	177
Average Downtime per break down, cycles	40	50	60	55	45
Number of break down, N	8	5	6	10	9
Cycle time, min	1.5				

Question 28

8-station flow line performs processing operations has been an observed for a period of production during of three weeks and has a cycle time of 1.25 minute. Line operation data is given in table (1).

Table (1) Operation data

Station	1	2	3	4	5	6	7	8
Average operation, cycles	600	450	660	520	590	379	760	520
Average breakdown, cycles	40	30	58	56	50	61.5	60	54

Determine the following:

a) The number of breakdown for each station during the observed time
b) Number of parts completed
c) Failure and repair rate of stations
d) If the system operate 70% under upper bound approach and 30% under lower bound approach:- Find (1) Production rate; (2) Line efficiency; (3) Acceptable number of parts; (4) Defect parts., (5) cost of product, if the operating cost is equal 40 SR/hr and ignoring other costs.
e) If the line is to be divided to stages, find the number of stages which give minimum cost if the buffer cost is1000 SR/hr for parts produced during the studied period of production.

Question 29

6-station flow line performs processing operations has been an observed during production period of two weeks and has a cycle time of 1.2 minute. Line operation data is given in table (4).

Table (4) Operation data

Station	1	2	3	4	5	6
Average operation, cycles	600	450	720	355	530	700
Average breakdown, cycles	66.67	50	80	45	41.43	100

Determine the following:

a) The number of breakdown for each station during the observed time
b) Number of parts completed
c) Failure and repair rate of stations.
d) If the system operate 75% under upper bound approach and 25% under lower bound approach:- Find (1) Production rate; (2) Line efficiency; (3) Acceptable number of parts; (4) Defect parts., (5) cost of product, if the operating cost is equal 600 SR/hr and ignoring other costs.
e) When the line is to be divided into two stages, find buffer size (b) that will minimize unit product cost. The cost of installing the storage buffer is equal 0.06b SR/min, where b = the buffer capacity. This buffer is constructed to store increment of (25).

Question 30
8-station flow line performs processing operations has been an observed for a period of production during of three weeks and has a cycle time of 1.0 minute. Line operation data is given in table (1).

Table (1) Operation data

Station	1	2	3	4	5	6	7	8
Average operation, cycles	500	380	570	500	450	440	660	520
Average breakdown, cycles	34	20	30	40	50	40	60	55

Determine the following:
a) The number of breakdown for each station during the observed time
b) Number of parts completed
c) Failure and repair rate of stations.
d) If the system operate 70% under upper bound approach and 30% under lower bound approach:- Find (1) Production rate; (2) Line efficiency; (3) Acceptable number of parts; (4) Defect parts; (5) cost of product, if the operating cost is equal 60 SR/hr and ignoring other costs.
e) If the line is to be divided to stages, find the number of stages which give minimum cost if the buffer cost is10 SR/hr for parts produced during the studied period of production.

Question 31
A three-week study is performed on a 6-stations transfer line. The line behaves according data given in table (2).
a) **Determine** the failure and repair rate.
b) if the line operates as one stage under 70% operational dependent failure and 30% time dependent failure, **find** the following: (1) Line efficiency, (2) Production rate, (3) Acceptable number of parts, and (4) Defect parts, (5) cost of the line, if the operating cost is equal 50 SR/hr and ignoring other costs.
c) If the line is to be divided to two stages, and the line operate under operational dependent failure find the cost of the line, if the operating cost is equal 50 SR/hr and the buffer cost is 2000 SR for parts produced during the studied period of production. Ignore other costs.

Table (2)

Station	1	2	3	4	5	6
Number of break down	30	40	35	35	40	30
Average Downtime time, cycles	10					
Cycle time, min	2					

Question 32
6-station flow line performs processing operations has been an observed during production period of two weeks and has a cycle time of 1.25 minute. Line operation data is given in table (1).

Table (1) Operation data

Station	1	2	3	4	5	6
Average operation, cycles	600	450	660	520	590	379
Average breakdown, cycles	40	30	58	56	50	61.5

Determine the following:
a) The number of breakdown for each station during the observed time
b) Number of parts completed

c) Failure and repair rate of stations.
d) If the system operate 75% under upper bound approach and 25% under lower bound approach:- Find (1) Production rate; (2) Line efficiency; (3) Acceptable number of parts; (4) Defect parts., (5) cost of product, if the operating cost is equal 40 SR/hr and ignoring other costs.
e) If the line is to be divided to stages, find the number of stages which give minimum cost if the buffer cost is1000 SR/hr for parts produced during the studied period of production.
f) When the line is to be divided into two stages, find buffer size (b) that will minimize unit product cost. The cost of installing the storage buffer is equal 0.06b SR/min, where b = the buffer capacity. This buffer is constructed to store increment of (10). The cost to operate the line is 600 SR/hr. Ignoring the material and tooling costs, ignoring the material and tooling costs

Question 33

8-station flow line performs processing operations has been an observed for a period of production during of three weeks and has a cycle time of 1.5 minute. Line operation data is given in table (1).

Table (1) Operation data

Station	1	2	3	4	5	6	7	8
Average operation, cycles	460	450	560	520	590	380	540	526
Average breakdown, cycles	40	30	58	56	50	55	60	54

Determine the following:

a) The number of breakdown for each station during the observed time
b) Number of parts completed
c) Failure and repair rate of stations.
d) If the system operate 70% under upper bound approach and 30% under lower bound approach:- Find (1) Production rate; (2) Line efficiency; (3) Acceptable number of parts; (4) Defect parts; (5) cost of product, if the operating cost is equal 60 SR/hr and ignoring other costs.
e) If the line is to be divided to stages, find the number of stages which give minimum cost if the buffer cost is10 SR/hr for parts produced during the studied period of production.

Question 34

20-station flow line performs processing operations has been an observed for a period of production during which 2400 pieces is produced with cycle time of 1.5 minute. Each station operated on averege 225 cycle per stop. The station stoped 10 times with average repair time 15 cycles. Determine the following:

a) The period of observation and number of parts completed
b) Failure and repair rate of stations.
c) Failure and repair rate of stations.
d) If the system operate 75% under upper bound approach and 25% under lower bound approach:- Find (1) Production rate; (2) Line efficiency; (3) Acceptable number of parts; (4) Defect parts., (5) cost of the line, if the operating cost is equal 50 SR/hr and ignoring other costs.
e) If the line is to be divided to stages, find the number of stages which give minimum cost if the buffer cost is 900 SR/hr for parts produced during the studied period of production.

Question 35

12-station flow line performs processing operations with cycle time of 1.0 minute. Each station operats 225 cycle and then fails. During the observed period, fuilure occurred on the average 10 times with average repair time 15 cycles.Determine the following:

a) The period of observation
b) The number of parts completed
c) Failure and repair rate of stations
d) Frequency of line stop per cycle
e) If the system operate 75% under upper bound approach and 25% under lower bound approach:- Find (1) Production rate; (2) Line efficiency; (3) Acceptable number of parts; (4) Defect parts., (5) cost of the line, if the operating cost is equal 50 SR/hr and ignoring other costs.
f) If the line is to be divided to 2, 3 & 4 stages, find the cost if the buffer cost is 900 SR/hr for parts produced during the studied period of production. Explain what the trend of the cost and efficiency values.