SYJC - I MATHEMATICS & STATISTICS

HIGHLIGHTS

- ✓ SOLUTION TO ALL QUESTIONS
- ✓ SOLUTIONS ARE PUT IN WAY THE STUDENT IS EXPECTED TO REPRODUCE IN THE BOARD EXAM
- ✓ TAUGHT IN THE CLASS ROOM THE SAME WAY AS THE SOLUTION ARE PUT UP HERE . THAT MAKES THE STUDENT TO EASILY GO THROUGH THE SOLUTION & PREPARE HIM/HERSELF WHEN HE/SHE SITS BACK TO REVISE AND RECALL THE TOPIC AT ANY GIVEN POINT OF TIME .
- ✓ LASTLY, IF STUDENT DUE TO SOME UNAVOIDABLE REASONS , HAS MISSED THE LECTURE , WILL NOT HAVE TO RUN HERE AND THERE TO UPDATE HIS/HER NOTES .
- ✓ HOWEVER STUDENT IS REQUESTED NOT TO MISUSE THE ABOVE POINT AS CLASS ROOM LECTURES ARE MUST FOR EASY PASSAGE OF UNDERSTANDING & LEARNING THE MINUEST DETAILS OF THE GIVEN TOPIC

PAPER - II

SEQUENCING

Compiled & Conducted At JKSC

SEQUENCING

N – JOBS ON 2 MACHINES

Q1. Find the sequence that minimizes total elapsed time (in hours) required to complete the following jobs on two machines M_1 and M_2 in the order M_1M_2 . Also find the minimum elapsed time and idle time for two machines

01 .

Job	A	B	C	D	E
M_1	6	2	10	4	11
M_2	3	7	8	9	5

Step 1 : Finding the optimal sequence

Min time = 2 on job B on machine M_1 . Place the job at the start of the sequence

B				

Next min time = 3 on job A on machine M_2 . Place the job at the end of the sequence

B				**A**

Next min time = 4 on job D on machine M_1 . Place it at the start of the sequence after B

B	**D**			**A**

Next min time = 5 on job E on machine M_2 . Place it at the end of the sequence before A

B	**D**		**E**	**A**

OPTIMAL SEQUENCE

B	**D**	**C**	**E**	**A**

Step 2 : Work table

According to the optimal sequence

Job	B	D	C	E	A	**total process time**
M_1	2	4	10	11	6	= 33 hrs
M_2	7	9	8	5	3	= 32 hrs

WORK TABLE

	MACHINES				
	M_1		M_2		Idle time
JOBS	IN	OUT	IN	OUT	on M_2
B	0	2	2	9	2
D	2	6	9	18	
C	6	16	18	26	
					1
E	16	27	27	32	
					1
A	27	33	33	36	

Step 3 :

Total elapsed time T = 36 hrs

Idle time on M_1 = T – (sum of processing time of all jobs on M1)

= 36 – 33

= 3 hrs

Idle time on M_2 = T – (sum of processing time of all jobs on M2)

= 36 – 32

= 4 hr (**CHECK** : 2 + 1 + 1 = 4)

02 . **(MARCH 14 , OCT 14)**

Job	A	B	C	D	E
M_1	5	1	9	3	10
M_2	2	6	7	8	4

Step 1 : Finding the optimal sequence

Min time = 1 on job B on machine M_1 . Place the job at the start of the sequence

B				

Next min time = 2 on job A on machine M_2 . Place the job at the end of the sequence

B				**A**

Next min time = 3 on job D on machine M_1 . Place it at the start of the sequence after B

B	**D**			**A**

Next min time = 4 on job E on machine M_2 . Place it at the end of the sequence before A

B	**D**		**E**	**A**

OPTIMAL SEQUENCE

B	**D**	**C**	**E**	**A**

Step 2 : Work table

According to the optimal sequence

Job	B	D	C	E	A	**total process time**	
M_1	1	3	9	10	5	=	28 hrs
M_2	6	8	7	4	2	=	27 hrs

WORK TABLE

	MACHINES				
	M_1		M_2		Idle time
JOBS	IN	OUT	IN	OUT	on M_2
B	0	1	1	7	1
D	1	4	7	15	
C	4	13	15	22	
					1
E	13	23	23	27	
					1
A	23	28	28	30	

Step 3 :

Total elapsed time T = 30 hrs

Idle time on M_1 = T – (sum of processing time of all jobs on M1)

= 30 – 28

= 2 hrs

Idle time on M_2 = T – (sum of processing time of all jobs on M2)

= 30 – 27

= 3 hrs (**CHECK** : 1 + 1 + 1 = 3)

Q2. The time (in hours) required to perform printing and binding operation (in that order) for each book is given in the following table **(MARCH 2014)**

Book	I	II	III	IV	V
Printing M_1	3	7	4	5	7
Binding M_2	6	2	7	3	4

Find the sequence that minimizes the total elapsed time to complete the work . Also find the minimum elapsed time T and idle time for two machines

Step 1 : Finding the optimal sequence

Min time = 2 on job II on machine M_2 . Place the job at the end of the sequence

				II

Next min time = 3 on job I on machine M_1 & on job IV on machine M_2 . Place the job I at the start of the sequence & job IV at the end of the sequence before II

I			**IV**	**II**

Next min time = 4 on job III on machine M_1 & on job V on machine M_2 . Place the job III at the start of the sequence after I & job V at the end of the sequence before IV

I	**III**	**V**	**IV**	**II**

OPTIMAL SEQUENCE

I	**III**	**V**	**IV**	**II**

Step 2 : Work table

According to the optimal sequence

Job	I	III	V	IV	II	**total process time**	
M_1	3	4	7	5	7	=	26 hrs
M_2	6	7	4	3	2	=	22 hrs

WORK TABLE

	MACHINES				
	M_1		M_2		Idle time
JOBS	IN	OUT	IN	OUT	on M_2
I	0	3	3	9	3
III	3	7	9	16	
V	7	14	16	20	
IV	14	19	20	23	
II	19	26	26	28	3

Step 3 :

Total elapsed time T = 28 hrs

Idle time on M_1 = T – (sum of processing time of all jobs on M1)

= 28 – 26

= 2 hrs

Idle time on M_2 = T – (sum of processing time of all jobs on M2)

= 28 – 22

= 6 hrs (**CHECK** : 3 + 3 = 6)

Q3. Find the sequence that minimizes total elapsed time (in hours) required to complete the following jobs on two machines M_1 and M_2 in the order M_1M_2 . Also find the minimum elapsed time and idle time for two machines

Job	A	B	C	D	E	F
M_1	5	9	4	7	8	6
M_2	7	4	8	3	9	5

Step 1 : Finding the optimal sequence

Min time = 3 on job D on machine M_2 . Place the job at the end of the sequence

					D

Next min time = 4 on job B on machine M_2 & on job C on machine M_1 . Place the job B at the end of the sequence before D & job C at the start of the sequence sequence

C				**B**	**D**

Next min time = 4 on job A on machine M_1 & on job F on machine M_2 . Place the job A at the start of the sequence after C & job F at the end of the sequence before B

C	**A**		**F**	**B**	**D**

OPTIMAL SEQUENCE

C	**A**	**E**	**F**	**B**	**D**

Step 2 : Work table

According to the optimal sequence

Job	C	A	E	F	B	D	**total process time**	
M_1	4	5	8	6	9	7	=	39 hrs
M_2	8	7	9	5	4	3	=	36 hrs

WORK TABLE

	MACHINES				
	M_1		M_2		Idle time
JOBS	IN	OUT	IN	OUT	on M_2
C	0	4	4	12	4
A	4	9	12	19	
E	9	17	19	28	
F	17	23	28	33	
B	23	32	33	37	
D	32	39	39	42	2

Step 3 :

Total elapsed time T = 42 hrs

Idle time on M_1 = T – (sum of processing time of all jobs on M1)

= 42 – 39

= 3 hrs

Idle time on M_2 = T – (sum of processing time of all jobs on M2)

= 42 – 36

= 6 hrs (**CHECK** : 4 + 2 = 6)

Q4. A book binder has one printing press , one binding machine and the manuscripts of a number of books . The time required to perform the printing and binding operations for each book are given below . Determine the order in which books should be processed in order to minimize the total time required to turn out all the books . Also find the idle time for both the machines

Jobs	1	2	3	4	5	6
Machine A	30	120	50	20	90	110
Machine B	80	100	90	60	30	10

Step 1 : Finding the optimal sequence

Min time = 10 on job 6 on machine B . Place the job at the end of the sequence

					6

Next Min time = 20 on job 4 on machine A . Place the job at the end of the sequence

4					**6**

Next min time = 30 on job 1 on machine A & on job 5 on machine B . Place the job 1 at the start of the sequence after 4 & job 5 at the end of the sequence before 6

4	**1**			**5**	**6**

Next min time = 50 on job 3 on machine A . Place the job at the start of the sequence after 1

4	**1**	**3**		**5**	**6**

OPTIMAL SEQUENCE

4	**1**	**3**	**2**	**5**	**6**

Step 2 : Work table

According to the optimal sequence

Job	4	1	3	2	5	6	**total process time**	
M_1	20	30	50	120	90	110	=	420
M_2	60	80	90	100	30	10	=	370

WORK TABLE

	MACHINES				
	M_1		**M_2**		**Idle time**
JOBS	**IN**	**OUT**	**IN**	**OUT**	**on M_2**
4	0	20	20	80	20
1	20	50	80	160	
3	50	100	160	250	
2	100	220	250	350	
5	220	310	350	380	
6	310	420	420	430	40

Step 3 :

Total elapsed time T = 430 units

Idle time on M_1 = T – (sum of processing time of all jobs on M1)

= 430 – 420

= 10 units

Idle time on M_2 = T – (sum of processing time of all jobs on M2)

= 430 – 370

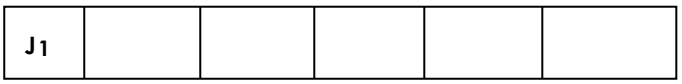
= 60 units (**CHECK** : 20 + 40 = 60)

Q5. In a factory there are six jobs to be performed , each of which should go through machines A and B in the order A – B . Determine the sequence for performing the jobs that would minimize the total elapsed time T . Find T and the idle time on the two machines **(OCT 2014)**

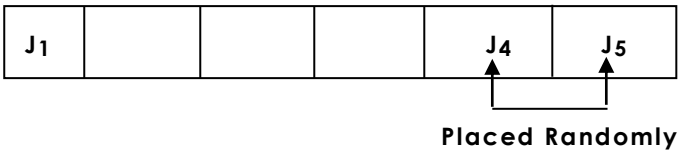
Job	J_1	J_2	J_3	J_4	J_5	J_6
M_A	1	3	8	5	6	3
M_B	5	6	3	2	2	10

Step 1 : Finding the optimal sequence

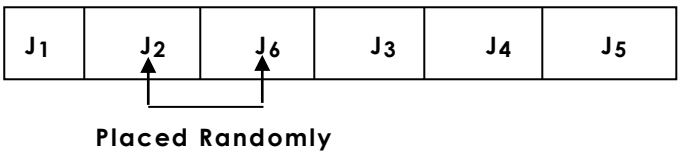
Min time = 1 on job J_1 on machine M_A . Place the job at the start of the sequence



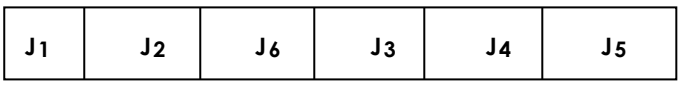
Next min time= 2 on jobs J_4 & J_5 on machine M_B . Place the jobs at the end of the sequence randomly



Next min time = 3 on jobs J_2 & J_6 on machine M_A and on job J_3 on machine M_B respectively . Place J_2 & J_6 at the start next to J_1 randomly and J_3 at the end before J_4



OPTIMAL SEQUENCE



Step 2 : Work table

According to the optimal sequence

Job	**J_1**	**J_2**	**J_6**	**J_3**	**J_4**	**J_5**	**total process time**
M_A	1	3	3	8	5	6	= 26 hrs
M_B	5	6	10	3	2	2	= 28 hrs

WORK TABLE

	MACHINES				
	M_A		M_B		Idle time
JOBS	IN	OUT	IN	OUT	on M_B
J_1	0	1	1	6	1
J_2	1	4	6	12	
J_6	4	7	12	22	
J_3	7	15	22	25	
J_4	15	20	25	27	
J_5	20	26	27	29	

Step 3 :

Total elapsed time T = 29 hrs

Idle time on M_A = T – (sum of processing time of all 6 jobs on M1)

= 29 – 26

= 3 hrs

Idle time on M_B = T – (sum of processing time of all 6 jobs on M2)

= 29 – 28

= 1 hr

Step 4 : All possible optimal sequences :

$J_1 - J_2 - J_6 - J_3 - J_4 - J_5$

OR

$J_1 - J_6 - J_2 - J_3 - J_4 - J_5$

OR

$J_1 - J_2 - J_6 - J_3 - J_5 - J_4$

OR

$J_1 - J_6 - J_2 - J_3 - J_5 - J_4$

Q6. We have seven jobs each of which has to go through the machines M_1 and M_2 in the order M_1M_2 . Processing time in hours are given below

Jobs	1	2	3	4	5	6	7
M_1	3	12	15	6	10	11	9
M_2	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed T , idle time for machine M_1 and idle time for Machine M_2 **(MARCH 2017)**

Step 1 : Finding the optimal sequence

Min time = 1 on job 6 on machine M_2 . Place the job at the end of the sequence

						6

Next min time= 3 on job 1 on machine M_1 & on job 7 on machine M_2 . Place job 1 at the start of the sequence and job 7 at the end of the sequence before job 1

1					**7**	**6**

Next min time= 6 on job 4 on machine M_1 & M_2 . Place job 4 at the start of the sequence after job 1

1	**4**				**7**	**6**

Next min time = 10 on jobs 2 & 3 on machine M_2 and on job 5 on machine M_1 respectively . Place 2 & 3 at the end of the sequence randomly before job 7 . and job 5 at the start of the sequence after 1

1	**4**	**5**	**2**	**3**	**7**	**6**

Placed Randomly

OPTIMAL SEQUENCE

1	**4**	**5**	**2**	**3**	**7**	**6**

Step 2 : Work table

According to the optimal sequence

Job	1	4	5	2	3	7	**6**		**total process time**
M_1	3	6	10	12	15	9	11	=	66 hrs
M_2	8	6	12	10	10	3	1	=	50 hrs

WORK TABLE

	MACHINES				
	M_1		**M_2**		**Idle time**
JOBS	**IN**	**OUT**	**IN**	**OUT**	**on M_2**
1	0	3	3	11	3
4	3	9	11	17	
5	9	19	19	31	2
2	19	31	31	41	
3	31	46	46	56	5
7	46	55	56	59	
6	55	66	66	67	7

Step 3 :

Total elapsed time T = 67 hrs

Idle time on M_1 = T – (sum of processing time of all jobs on M1)

= 67 – 66

= 1 hrs

Idle time on M_2 = T – (sum of processing time of all jobs on M2)

= 67 – 50

= 17 hrs (**CHECK** : 3 + 2 + 5 + 7 = 17)

SEQUENCING

N – JOBS ON 3 MACHINES

Q1. Find the sequence that minimizes total elapsed time (in hours) required to complete the following jobs on three machines M_1 , M_2 and M_3 in the order M_1-M_2-M_3 . Also find the minimum elapsed time and idle time for all three machines

Job	A	B	C	D	E
M_1	5	7	6	9	5
M_2	2	1	4	5	3
M_3	3	7	5	6	7

STEP 1 : Min time on M_1 = 5 ;

Max time on M_2 = 5

Min time on M_3 = 3

Min (M_1) ≥ Max (M_2) ..... condition satisfied to convert 3 m/c's to 2 m/c's

STEP 2 : CONVERTING TO 2 FICTITIOUS M/C'S G & H

G = M_1 + M_2

H = M_2 + M_3

Job	A	B	C	D	E
G	7	8	10	14	8
H	5	8	9	11	10

STEP 3 : OPTIMAL SEQUENCE

Min time = 5 on job A on machine H . Place the job at the end of the sequence

				A

Next min time = 8 on job B & E on machine G . Place them randomly at the start of the sequence

B	**E**			**A**

Next min time = 9 on job C on machine H . Place it at the end of the sequence before A

B	**E**		**C**	**A**

OPTIMAL SEQUENCE

B	E	D	C	A

STEP 4 : WORK TABLE

Job	B	E	D	C	A		total process time
M_1	7	5	9	6	5	=	32 hrs
M_2	1	3	5	4	2	=	15 hrs
M_3	7	7	6	5	3	=	28 hrs

JOBS	M_1		IDLE	M_2		IDLE	M_3		IDLE
	IN	OUT	TIME	IN	OUT	TIME	IN	OUT	TIME
						7			8
B	0	7	--	7	8	4	8	15	--
E	7	12	--	12	15	6	15	22	4
D	12	21	--	21	26	1	26	32	--
C	21	27	--	27	31	1	32	37	--
A	27	32	8	32	34	6	37	40	--

STEP 5 : Total elapsed time T = 40 hrs

Idle time on M_1 = T – (sum of processing time of all 5 jobs on M1)

= 40 – 32

= 8 hrs

Idle time on M_2 = T – (sum of processing time of all 5 jobs on M2)

= 40 – 15

= 25 hrs (CHECK – 7 + 4 + 6 + 1 + 1 + 6 = 25)

Idle time on M_3 = T – (sum of processing time of all 5 jobs on M3)

= 40 – 28

= 12 hrs (CHECK – 8 + 4 = 12)

Q2. **1.** There are five jobs , each of which is to be processed through three machines A , B and C in the order ABC . Processing time in hours are shown in the following table .Determine the optimal sequence for the five jobs and the minimum elapsed time . Also find the idle time for three machines

Job	1	2	3	4	5
A	3	8	7	5	2
B	3	4	2	1	5
C	5	8	10	7	6

STEP 1 : Min time on m/c A = 2 ;

Max time on m/c B = 5 Min (m/c C) ≥ Max (m/c B)

Min time on m/c C = 5 ..... condition satisfied to convert 3 m/c's to 2 m/c's

STEP 2 : CONVERTING TO 2 FICTITIOUS M/C'S G & H

G = A + B

H = B + C

Job	1	2	3	4	5
G	6	12	9	6	7
H	8	12	12	8	11

STEP 3 : OPTIMAL SEQUENCE

Min time = 6 on job 1 & 4 on machine G . Place them **RANDOMLY** at the start of the sequence

1	**4**			

Next min time = 7 on job 5 on machine H . Place it at the end of the sequence

1	**4**	**5**		

Next min time = 9 on job 3 on machine G . Place it at the start of the sequence after 5

1	**4**	**5**	**3**	

OPTIMAL SEQUENCE

1	**4**	**5**	**3**	**2**

STEP 4 : WORK TABLE

Job	1	4	5	3	2		TOTAL PROCESSING TIME
A	3	5	2	7	8	=	25 HRS
B	3	1	5	2	4	=	15 HRS
C	5	7	6	10	8	=	36 HRS

JOBS	M/c A		IDLE	M/c B		IDLE	M/c C		IDLE
	IN	OUT	TIME	IN	OUT	TIME	IN	OUT	TIME
						3			6
1	0	3	--	3	6	2	6	11	--
4	3	8	--	8	9	1	11	18	--
5	8	10	--	10	15	2	18	24	--
3	10	17	--	17	19	6	24	34	--
2	17	25	17	25	29	13	34	42	--

STEP 5 : Total elapsed time T = 42 hrs

Idle time on M/c A = T – (sum of processing time of all 5 jobs on M/c A)

= 42 – 25

= 17 hrs

Idle time on M/c B = T – (sum of processing time of all 5 jobs on M/c B)

= 42 – 15

= 27 hrs (CHECK – 3 + 2 + 1 + 2 + 6 + 13 = 27)

Idle time on M/c C = T – (sum of processing time of all 5 jobs on M/c C)

= 42 – 36

= 6 hrs

Q2. **2.** There are five jobs , each of which is to be processed through three machines A , B and C in the order ABC . Processing time in hours are shown in the following table .Determine the optimal sequence for the five jobs and the minimum elapsed time . Also find the idle time for three machines

Job	1	2	3	4	5
A	3	8	7	5	4
B	4	5	1	2	3
C	7	9	5	6	10

(JULY 2016)

STEP 1 : Min time on m/c A = 3 ;

Max time on m/c B = 5 Min (m/c C) ≥ Max (m/c B)

Min time on m/c C = 5 ..... condition satisfied to convert 3 m/c's to 2 m/c's

STEP 2 : CONVERTING TO 2 FICTITIOUS M/C'S G & H

G = A + B

H = B + C

Job	1	2	3	4	5
G	7	13	8	7	7
H	11	14	6	8	13

STEP 3 : OPTIMAL SEQUENCE

Min time **=** 6 on job 3 on machine H . Place the job at the end of the sequence

				3

Next min time = 7 on jobs 1 , 4 & 5 on machine G . Place them randomly at the start of the sequence

1	**4**	**5**		**3**

RANDOM

OPTIMAL SEQUENCE

1	**4**	**5**	**2**	**3**

STEP 4 : WORK TABLE

Job	1	4	5	2	3		TOTAL PROCESSING TIME
A	3	5	4	8	7	=	27 hrs
B	4	2	3	5	1	=	15 hrs
C	7	6	10	9	5	=	37 hrs

JOBS	M/c A		IDLE	M/c B		IDLE	M/c C		IDLE
	IN	OUT	TIME	IN	OUT	TIME	IN	OUT	TIME
						3			7
1	0	3	--	3	7	1	7	14	--
4	3	8	--	8	10	2	14	20	--
5	8	12	--	12	15	5	20	30	--
2	12	20	--	20	25	2	30	39	--
3	20	27	17	27	28	16	39	44	--

STEP 5 : Total elapsed time T = 44 hrs

Idle time on M/c A = T – [sum of processing time of all 5 jobs on M/c A]

= 44 – 27

= 17 hrs

Idle time on M/c B = T – [sum of processing time of all 5 jobs on M/c B]

= 44 – 15

= 29 hrs (CHECK – 3 + 1 + 2 + 5 + 2 + 16 = 29)

Idle time on M/c C = T – [sum of processing time of all 5 jobs on M/c C]

= 44 – 37

= 7 hrs

Q3. Determine the optimal sequence involving 5 jobs and three machines M_1 , M_2 and M_3 . The jobs are processed on three machines in the order $M_1M_2M_3$. Also find the minimum total elapsed time T and idle time for three machines . Processing time in minutes are

Job	J_1	J_2	J_3	J_4	J_5
M_1	7	12	11	9	8
M_2	8	9	5	6	7
M_3	11	13	9	10	14

STEP 1 : Min time on M_1 = 7 ;

Max time on M_2 = 9

Min time on M_3 = 9

Min (M_3) ≥ Max (M_2) ..... condition satisfied to convert 3 m/c's to 2 m/c's

STEP 2 : CONVERTING TO 2 FICTITIOUS M/C'S G & H

G = M_1 + M_2

H = M_2 + M_3

Job	J_1	J_2	J_3	J_4	J_5
G	15	21	16	15	15
H	19	22	14	16	21

STEP 3 : OPTIMAL SEQUENCE

Min time = 14 on job J_3 on machine H . Place the job at the end of the sequence

				J_3

Next min time = 15 on job J_1 , J_4 & J_5 on machine G . Place them randomly at the start of the sequence

J_1	**J_4**	**J_5**		**J_3**

OPTIMAL SEQUENCE

J_1	**J_4**	**J_5**	**J_2**	**J_3**

STEP 4 : WORK TABLE

Job	J_1	J_4	J_5	J_2	J_3		total processing time
M_1	7	9	8	12	11	=	47 min
M_2	8	6	7	9	5	=	35 min
M_3	11	10	14	13	9	=	57 min

JOBS	**M_1**		**IDLE**	**M_2**		**IDLE**	**M_3**		**IDLE**
	IN	**OUT**	**TIME**	**IN**	**OUT**	**TIME**	**IN**	**OUT**	**TIME**
						7			15
J_1	0	7	--	7	15	1	15	26	--
J_4	7	16	--	16	22	2	26	36	--
J_5	16	24	--	24	31	5	36	50	--
J_2	24	36	--	36	45	2	50	63	--
J_3	36	47	25	47	52	20	63	72	--

STEP 5 : Total elapsed time T = 72 min

Idle time on M_1 = T – (sum of processing time of all 5 jobs on M1)

= 72 – 47

= 25 min

Idle time on M_2 = T – (sum of processing time of all 5 jobs on M2)

= 72 – 35

= 37 min (CHECK – 7 + 1 + 2 + 5 + 2 + 20 = 37)

Idle time on M_3 = T – (sum of processing time of all 5 jobs on M3)

= 72 – 57

= 15 min

NOTE : ALL POSSIBLE OPTIMAL SEQUENCES

i) $J_1 – J_4 – J_5 – J_2 – J_3$

ii) $J_1 – J_5 – J_4 – J_2 – J_3$

iii) $J_4 – J_1 – J_5 – J_2 – J_3$

iv) $J_4 – J_5 – J_1 – J_2 – J_3$

v) $J_5 – J_1 – J_4 – J_2 – J_3$

vi) $J_5 – J_4 – J_4 – J_2 – J_3$

However there are 6 possible different optimal sequences but the total elapsed time T and the idle time on all three m/c's will remain the same

Q4. A machine operator has to perform three operations : turning , threading and finishing on 6 different jobs . The time required to perform these operations (in minutes) for each job is given below . Determine the order in which the jobs should be processed in order to minimize the total time required to complete all the jobs . Also find the idle time three operation

Jobs	1	2	3	4	5	6
Turning	3	12	5	2	9	11
Threading	8	6	4	6	3	1
Finishing	13	14	9	12	8	13

STEP 1 : Min time on Turning (m/c A) = 2 ;

Max time on Threading(m/c B) = 8

Min time on Fininshing (m/c C) = 8 Min (m/c C) ≥ Max (m/c B)

STEP 2 : CONVERTING TO 2 FICTITIOUS M/C'S G & H

G = A + B

H = B + C

Job	1	2	3	4	5	6
G	11	18	9	8	12	12
H	21	20	13	18	11	14

STEP 3 : OPTIMAL SEQUENCE

Min time = 8 on job 4 on machine G . Place the job at the start of the sequence

4					

Next min time = 9 on job 3 on machine G . Place it at start of sequence after 4

4	**3**				

Next min time = 11 on job 1 on G & on job 5 on H . Place job 1 at start of sequence after 3 and job 5 at the end of the sequence

4	**3**	**1**			**5**

Next min time = 12 on job 6 on machine G . Place it at start of sequence after 1

4	3	1	6		5

OPTIMAL SEQUENCE

4	3	1	6	2	5

STEP 4 : WORK TABLE

	JOBS						TOTAL PROCESSING
M/C	4	3	1	6	2	5	TIME
CUTTING	2	5	3	11	12	9	= 42 min
THREADING	6	4	8	1	6	3	= 28 min
FINISHING	12	9	13	13	14	8	= 69 min

JOBS	CUTTING		IDLE	THREADING		IDLE	FINISHING		IDLE
	IN	OUT	TIME	IN	OUT	TIME	IN	OUT	TIME
						2			8
4	0	2	--	2	8	--	8	20	--
3	2	7	--	8	12	--	20	29	--
1	7	10	--	12	20	1	29	42	--
6	10	21	--	21	22	11	42	55	--
2	21	33	--	33	39	3	55	69	--
5	33	42	35	42	45	32	69	77	--

STEP 5 : Total elapsed time T = 77 min

Idle time on CUTTING = T – [sum of processing time of all 5 jobs on M/c A]

= 77 – 42

= 35 min

Idle time on THREADING = T – [sum of processing time of all 5 jobs on M/c B]

= 77 – 28

= 49 min (CHECK – 2 + 1 + 11 + 3 + 32 = 49)

Idle time on FINISHING = T – [sum of processing time of all 5 jobs on M/c C]

= 77 – 69

= 8 min