2

Job	Processing Time (Hours)	Due Hour	Slack	Critical Ratio
a	(.14 x 45) + .7 = 7	4	4 -7 = -3	4 / 7 = .57
b	(.25 x 14) + .5 = 4	10	10 – 4 = 6	10 / 4 = 2.5
c	(.10 x 18) + .2 = 2	12	12 – 2 = 10	12 / 2 = 6
d	(.25 x 40) + 1 = 11	20	20 – 11 = 9	20 / 11 = 1.82
e	(.10 x 75) + .5 = 8	15	15 – 8 = 7	15 / 8 = 1.875

MST: a-b-e-d-c
SPT: c-b-a-e-d
EDD: a-b-c-e-d
CR: a-d-e-b-c

MST:

Job	Operation time (hr.)	Completion time (hr.)	Due hour	Hours Late
a	7	7	4	3
b	4	11	10	1
e	8	19	15	4
d	11	30	20	10
c	2	32	12	20
		99		38

SPT:

Job	Operation time (hr.)	Completion time (hr.)	Due hour	Hours Late
c	2	2	12	0
b	4	6	10	0
a	7	13	4	9
e	8	21	15	6
d	11	32	20	12
		74		27

EDD:

Job	Operation time (hr.)	Completion time (hr.)	Due hour	Hours Late
a	7	7	4	3
b	4	11	10	1
c	2	13	12	1
e	8	21	15	6
d	11	32	20	12
		84		23

CR:

Job	Operation time (hr)	Completion time (hr)	Due Hour	Hours late
a	7	7	4	3
d	11	18	20	0
e	8	26	15	11
b	4	30	10	20
c	2	32	12	20
		113		54

		MST	SPT	EDD	CR
$Average\ \ flow\ \ time = \frac{Flow\ \ time}{Number\ \ of\ \ jobs}$		$\frac{99}{5}=19.80$	$\frac{74}{5}=14.80$	$\frac{84}{5}=16.80$	$\frac{113}{5}=22.6$
$Average$ hours $late = \frac{Hours\ \ late}{Number\ \ of\ \ jobs}$		$\frac{38}{5}=7.60$	$\frac{27}{5}=5.40$	$\frac{23}{5}=4.60$	$\frac{54}{5}=10.8$
$Average\ \ no.of\ \ jobs\ \ at\ the\ center = \frac{Flow\ \ time}{\sum\ job\ \ times}$		$\frac{99}{32}=3.09$	$\frac{74}{32}=2.31$	$\frac{84}{32}=2.625$	$\frac{113}{32}=3.53$

For this data, there is no one superior priority rule. SPT has the lowest avg. flow time and avg. WIP, but EDD has the lowest avg. hours late.

3. a.

Job	Time (days)	Due Date	Slack	Critical Ratio
A	8	20	12	2.5
B	10	18	8	1.8
C	5	25	20	5.0
D	11	17	6	1.55
E	9	35	26	3.89

Sequences:
(1) CR: D-B-A-E-C
(2) MST: D-B-A-C-E
(3) SPT: C-A-E-B-D
(4) EDD: D-B-A-C-E

b. CR:

Job	Time (days)	Completion time (days)	Due Date	Days Late
D	11	11	17	0
B	10	21	18	3
A	8	29	20	9
E	9	38	35	3
C	5	43	25	18
		142		33

SPT:

Job	Time (days)	Completion time (days)	Due Date	Days Late
C	5	5	25	0
A	8	13	20	0
E	9	22	35	0
B	10	32	18	14
D	11	43	17	26
		115		40

EDD & MST

Job	Time (days)	Completion time (days)	Due Date	Days Late
D	11	11	17	0
B	10	21	18	3
A	8	29	20	9
C	5	34	25	9
E	9	43	35	8
		138		29

		CR	SPT	EDD & MST
Average flow time =	completion time: / number of jobs	$\frac{142}{5}=28.4$	$\frac{115}{5}=23$	$\frac{138}{5}=27.6$
Average days late =	total days late: / number of jobs	$\frac{33}{5}=6.6$	$\frac{40}{5}=8$	$\frac{29}{5}=5.8$

c. No, SPT has the smallest average flow time, but EDD & MST have the smallest average days late.

4. Using Johnson's rule:

Order	Time (hr.) Step 1		Step 2		Sequence of assignment:		
A	1.20	❸	1.40		.80	[C]	last (i.e., 7th)
B	0.90	❷	1.30		.90	[B]	first
C	2.00		0.80	❶	1.20	[A]	2nd
D	1.70		1.50	❺	1.30	[G]	3rd
E	1.60	❻	1.80		1.50	[D]	6th
F	2.20		1.75	❼	1.60	[E]	4th
G	1.30	❹	1.40		1.75	[F]	5th

Thus, processing sequence is B-A-G-E-F-D-C.

Note: Order of assignment is given in circles.

19. Each period's increase in WIP is equal to (actual input - actual output). That amount is added to (or subtracted from) the previous WIP to obtain the current (shown) WIP for the period.

1.

Number of recalibrations	Probability of occurrence	Number of expected problems
0	.15	0
1	.25	.25
2	.30	.60
3	.20	.60
4	.10	.40
	1.00	1.85

		Period				
		1	2	3	4	5
Input	Planned	24	24	24	24	20
	Actual	25	27	20	22	24
Output	Planned	24	24	24	24	23
	Actual	24	22	23	24	24
WIP		12	13	18	15	13	13