Exercises_Project Management

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Exercise 36

Some projects must be evaluated according to their competitive priorities. The decision-maker must identify the project to choose. Regarding the values you can assign a value equal to 1 associated to the benchmark and we use a range from 1 to 9 in function of the delta. Regarding the weights, it varies from 0% to 100%.

	Weight Project 1	Weight Project 2	Weight Project 3
Quality	20%	25%	20%
Cost	30%	30%	35%
Time	30%	25%	25%
Flexibility	20%	20%	20%

	Value Project 1	Value Project 2	Value Project 3	Benchmark	Delta
Quality	92%	86%	90%	80%	2%
Cost	100 €	50 €	80 €	120 €	10 €
Time	22 h	34 h	28 h	40 h	3 h
Flexibility	90%	81%	84%	75%	3%

Exercise 36

	Value Project 1	Value Project 2	Value Project 3
Quality	7	4	6
Cost	3	8	5
Time	7	3	5
Flexibility	6	3	4
	Project 1	Project 2	Project 3
Quality	1.4	1	1.2
Cost	0.9	2.4	1.75
Time	2.1	0.75	1.25
Flexibility	1.2	0.6	0.8
Total	**5.6**	**4.75**	**5**

Exercise 37

Activity	Predecessor	Duration
A		2
B		6
C		4
D	A	3
E	C	5
F	A	4
G	B,D,E	2

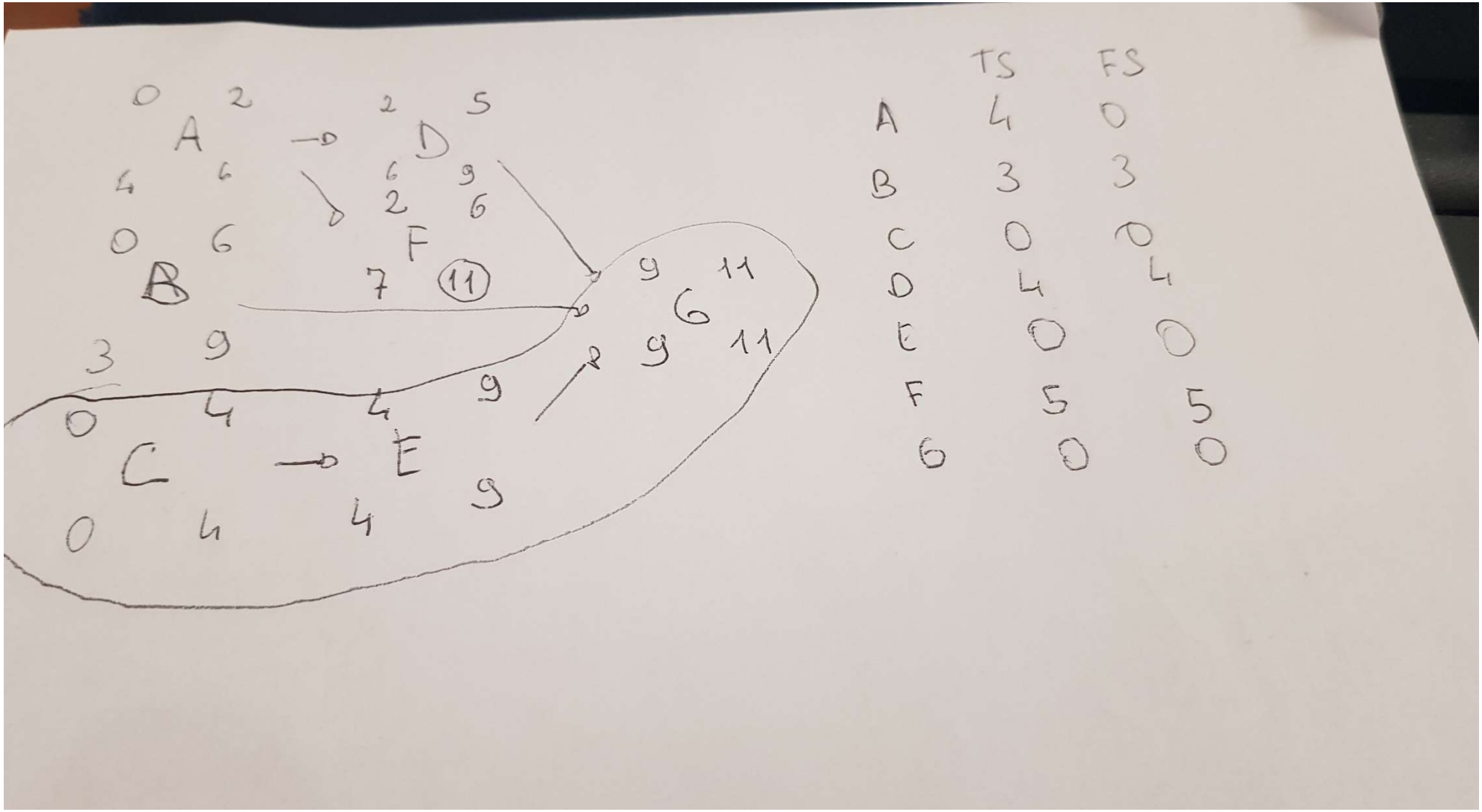
The following elements must be defined: early time, early finish, late start, late finish, total slack, free slack and critical path.

Exercise 37

	Es	Ef	Ls	Lf	TS	FS
A	0	2	4	6	4	0
B	0	6	3	9	3	3
C	0	4	0	4	0	0
D	2	5	6	9	4	4
E	4	9	4	9	0	0
F	2	6	7	11	5	5
G	9	11	9	11	0	0

Critical path: C-E-G

Exercise 37



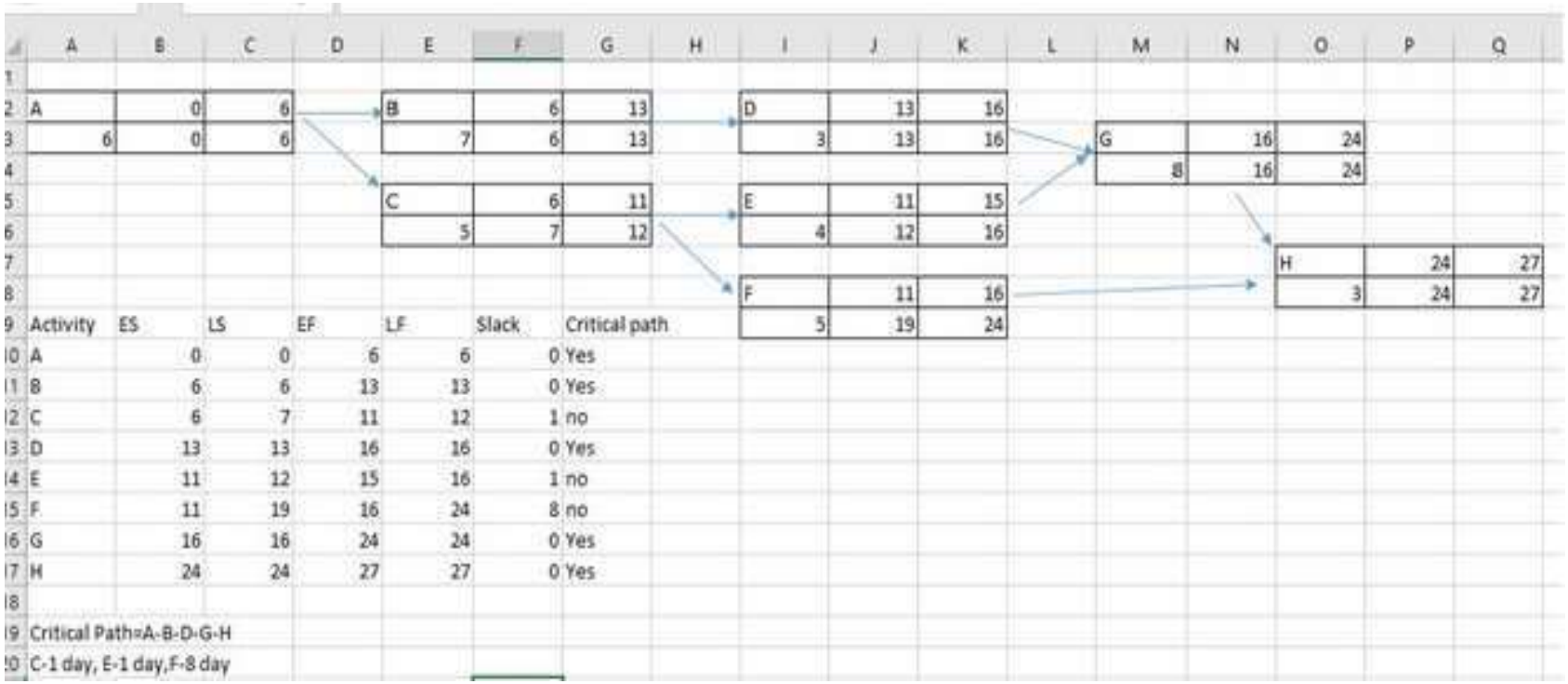
Exercise 38

Activity	Duration	Predecessors	Free Slack	Total Slack
A	6	--		
B	7	A		
C	5	A		
D	3	B		
E	4	C		
F	5	C		
G	8	D, E		
H	3	F, G		

What is the value of both total slack and free slack?

What is the critical path?

Exercise 38



Activity	ES	LS	EF	LF	Slack	Critical path
A	0	0	6	6	0	Yes
B	6	6	13	13	0	Yes
C	6	7	11	12	1	no
D	13	13	16	16	0	Yes
E	11	12	15	16	1	no
F	11	19	16	24	8	no
G	16	16	24	24	0	Yes
H	24	24	27	27	0	Yes

Critical Path=A-B-D-G-H

C-1 day, E-1 day,F-8 day

Free Slack (C = 0d, E = 1d, F = 8d)
Total Slack (C = 1d, E = 1d, F = 8d)

Exercise 39

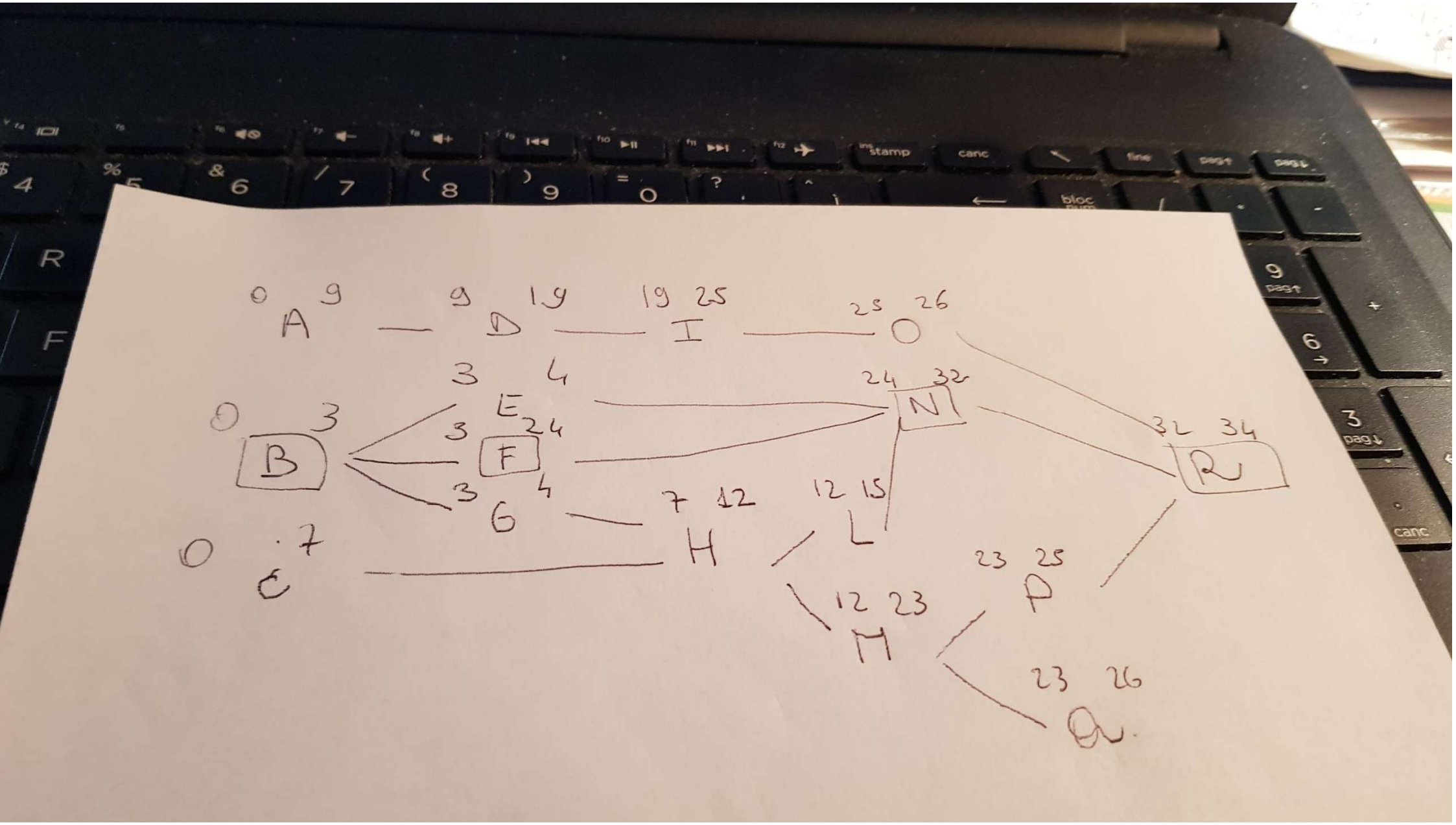
What is the critical path? Complete the following table.

Activity	d	Predec.	Es	Ef	Ls	Lf	TS	FS
A	9	-						
B	3	-						
C	7	-						
D	10	A						
E	1	B						
F	21	B						
G	1	B						
H	5	C,G						
I	6	D						
L	3	H						
M	11	H						
N	8	E,F,L						
O	1	I						
P	2	M						
Q	3	M						
R	2	O,N,P						

Exercise 39

Activity	d	Predec.	Es	Ef	Ls	Lf	TS	FS
A	9	-	0	9	6	15	6	0
B	3	-	0	3	0	3	0	0
C	7	-	0	7	7	14	7	0
D	10	A	9	19	15	25	6	0
E	1	B	3	4	23	24	20	20
F	21	B	3	24	3	24	0	0
G	1	B	3	4	13	14	10	3
H	5	C,G	7	12	14	19	7	0
I	6	D	19	25	25	31	6	0
L	3	H	12	15	21	24	9	9
M	11	H	12	23	19	30	7	0
N	8	E,F,L	24	32	24	32	0	0
O	1	I	25	26	31	32	6	6
P	2	M	23	25	30	32	7	7
Q	3	M	23	26	31	34	8	8
R	2	O,N,P	32	34	32	34	0	0

Critical path: B-F-N-R

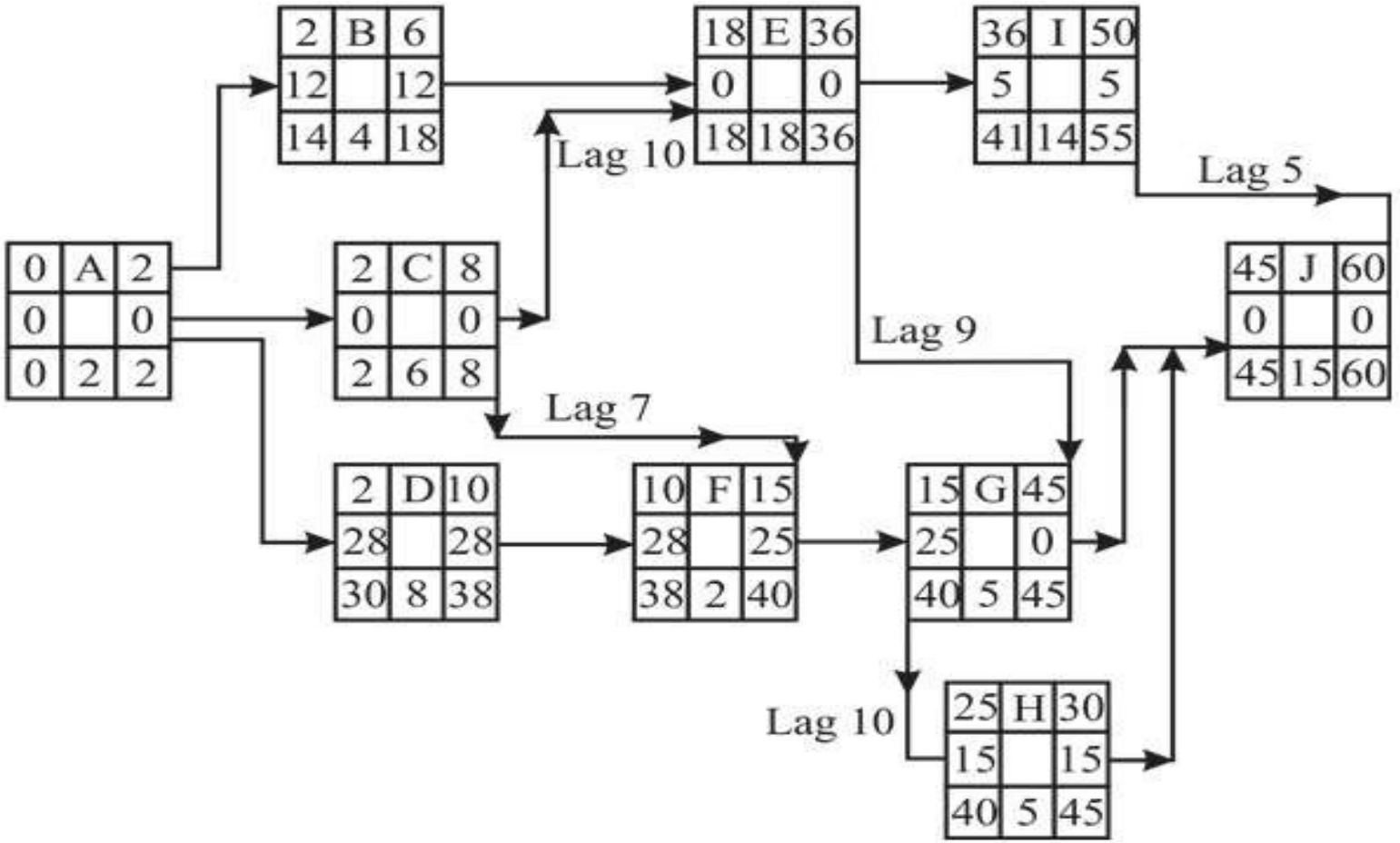

0
A
9
9
D
19
19
I
25
25
O
26
3
4
E
24
24
N
32
0
3
B
3
F
3
G
4
32
34
R
7
12
12
15
H
L
0
7
C
23
25
P
12
23
M
23
26
Q

Exercise 40

Compute the early, late and slack times for the project network. What is the period need to complete the project?

ID	Duration	Finish-to-Start Predecessor	Finish-to-Start Lag	Additional Lag Relationships	Lag
A	2	None	0	None	0
B	4	A	0	None	0
C	6	A	0	Finish-finish C to F	7
D	8	A	0	None	0
E	18	B	0	Finish-finish E to G	9
		C	10		
F	2	D	0	None	
G	5	F	0	Start-start G to H	10
H	5	None	0	None	0
I	14	E	0	Finish-finish I to J	5
J	15	G, H	0	None	0

Exercise 40



The period need to complete the project is 60.

Exercise 41

Activity	Precedence	d_{ott}	d_{pp}	d_{pess}
A	-	4	11	12
B	-	45	48	63
C	B	13	33	35
D	B	25	29	39
E	A,C	14	21	22
F	D,E	18	32	34
G	C	17	19	27
H	G	15	20	25

Time required for completing the project: 141 days (T_S)

What is the probability of ending the project in time?

Exercise 41

Z Value	Probability	*Z* Value	Probability
−3.0	.001	+0.0	.500
−2.8	.003	+0.2	.579
−2.6	.005	+0.4	.655
−2.4	.008	+0.6	.726
−2.2	.014	+0.8	.788
−2.0	.023	+1.0	.841
−1.8	.036	+1.2	.885
−1.6	.055	+1.4	.919
−1.4	.081	+1.6	.945
−1.2	.115	+1.8	.964
−1.0	.159	+2.0	.977
−0.8	.212	+2.2	.986
−0.6	.274	+2.4	.992
−0.4	.345	+2.6	.995
−0.2	.421	+2.8	.997

Exercise 41

Activity	Precedence	d_{ott}	d_{pp}	d_{pess}	$(t_e)\ d_{exp}$	VAR	σ
A	-	4	11	12	10	1,78	1,33
B	-	45	48	63	50*	9,00	3
C	B	13	33	35	30*	13,44	3,67
D	B	25	29	39	30	5,44	2,33
E	A,C	14	21	22	20*	1,78	1,33
F	D,E	18	32	34	30*	7,11	2,67
G	C	17	19	27	20	2,78	1,67
H	G	15	20	25	20	2,78	1,67

- Critical Path B-C-E-F
- Expected time for project ending (T_E) = 130 days
- $\sigma = \sqrt{\sigma^2} = \sqrt{(9+13,44+1,78+7,11)} = \sqrt{}\ 31,33 = 5.597$ (on the critical path)
- $Z = (T- T_E)/\ \sqrt{\sigma^2} = 11/5.597 = 1.96$
- Probability of ending the project in time: 97.50%
- Probability of having penalties due to delays: 2.50%

Exercise 42

	Pred.	a	m	b
A	-	2	9	10
B	-	15	26	31
C	A	8	11	20
D	B	2	5	8
E	B	3	4	5
F	C, D	16	31	40
G	E	14	20	32
H	F	1	3	11
I	F, G	20	22	24

Time required for completing the project: 90 (T_S)

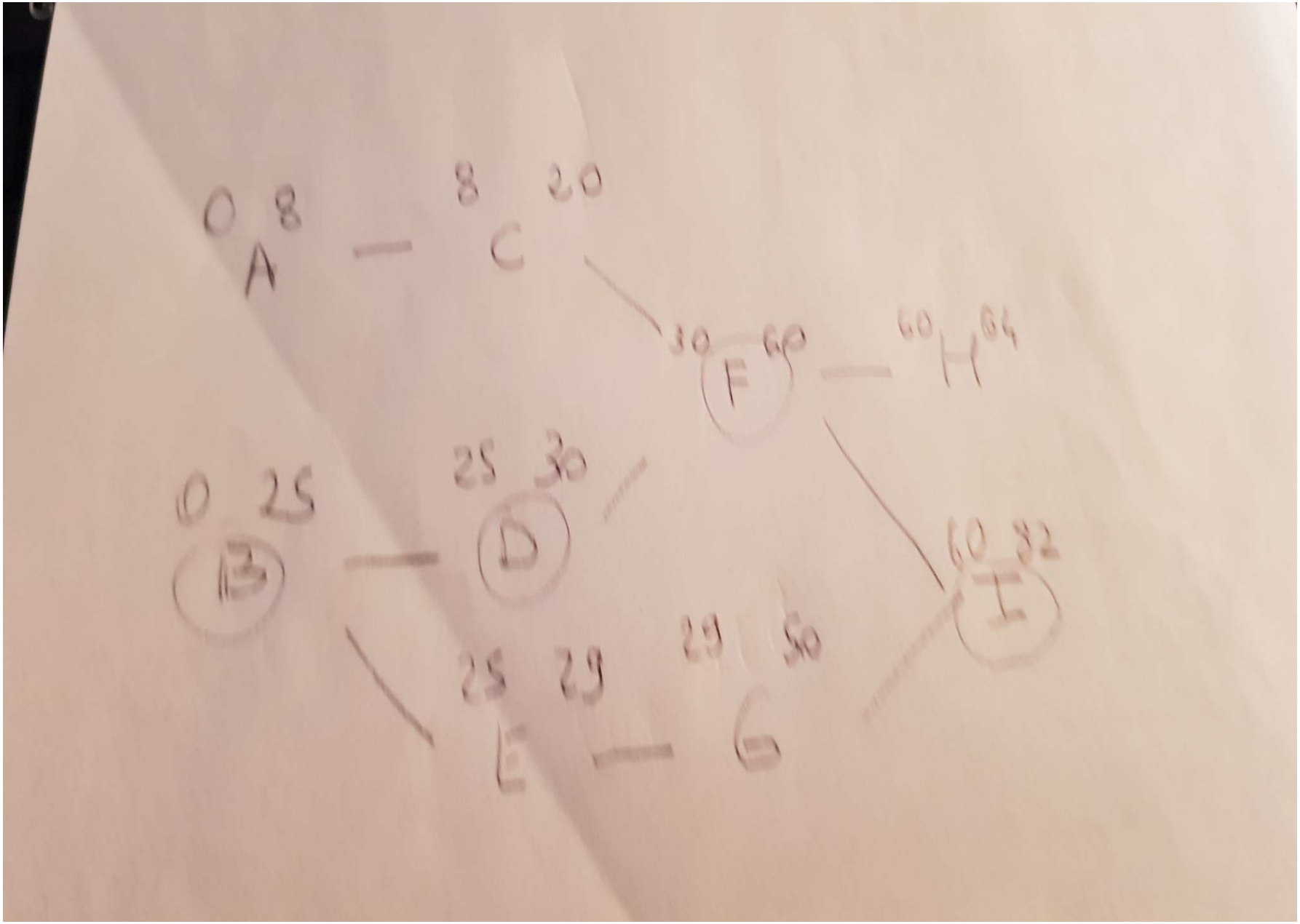
What is the critical path?

What is the value of both total slack and free slack?

What is the probability of ending the project in time?

Exercise 42

Z Value	Probability	*Z* Value	Probability
−3.0	.001	+0.0	.500
−2.8	.003	+0.2	.579
−2.6	.005	+0.4	.655
−2.4	.008	+0.6	.726
−2.2	.014	+0.8	.788
−2.0	.023	+1.0	.841
−1.8	.036	+1.2	.885
−1.6	.055	+1.4	.919
−1.4	.081	+1.6	.945
−1.2	.115	+1.8	.964
−1.0	.159	+2.0	.977
−0.8	.212	+2.2	.986
−0.6	.274	+2.4	.992
−0.4	.345	+2.6	.995
−0.2	.421	+2.8	.997


A
C
F
H
B
D
E
G
I

Exercise 42

		a	m	b	te	Var.	d.s.	ES	EF	LS	LF	TS	FS
A	-	2	9	10	8	1,78	1,33	0	8	10	18	10	0
B	-	15	26	31	25	7,11	2,67	0	25	0	25	0	0
C	A	8	11	20	12	4,00	2,00	8	20	18	30	10	10
D	B	2	5	8	5	1,00	1,00	25	30	25	30	0	0
E	B	3	4	5	4	0,11	0,33	25	29	35	39	10	0
F	C, D	16	31	40	30	16,00	4,00	30	60	30	60	0	0
G	E	14	20	32	21	9,00	3,00	29	50	39	60	10	10
H	F	1	3	11	4	2,78	1,67	60	64	78	82	18	18
I	F, G	20	22	24	22	0,44	0,67	60	82	60	82	0	0

Critical PATH: B - D - F - I			
Te			sigma Te
82			4,955356
			Z
Ts			1,614415
90			P
			0,95

Exercise 43

		a	m	b
A	-	2	9	10
B	A	15	26	31
C	A	8	11	20
D	B	2	5	8
E	B, C	3	4	5
F	C	16	31	40
G	E, F	14	20	32
H	D, E	1	3	11
I	G, H	20	22	24
L	H	2	32	50

Time required for completing the project: 95 (T_S)

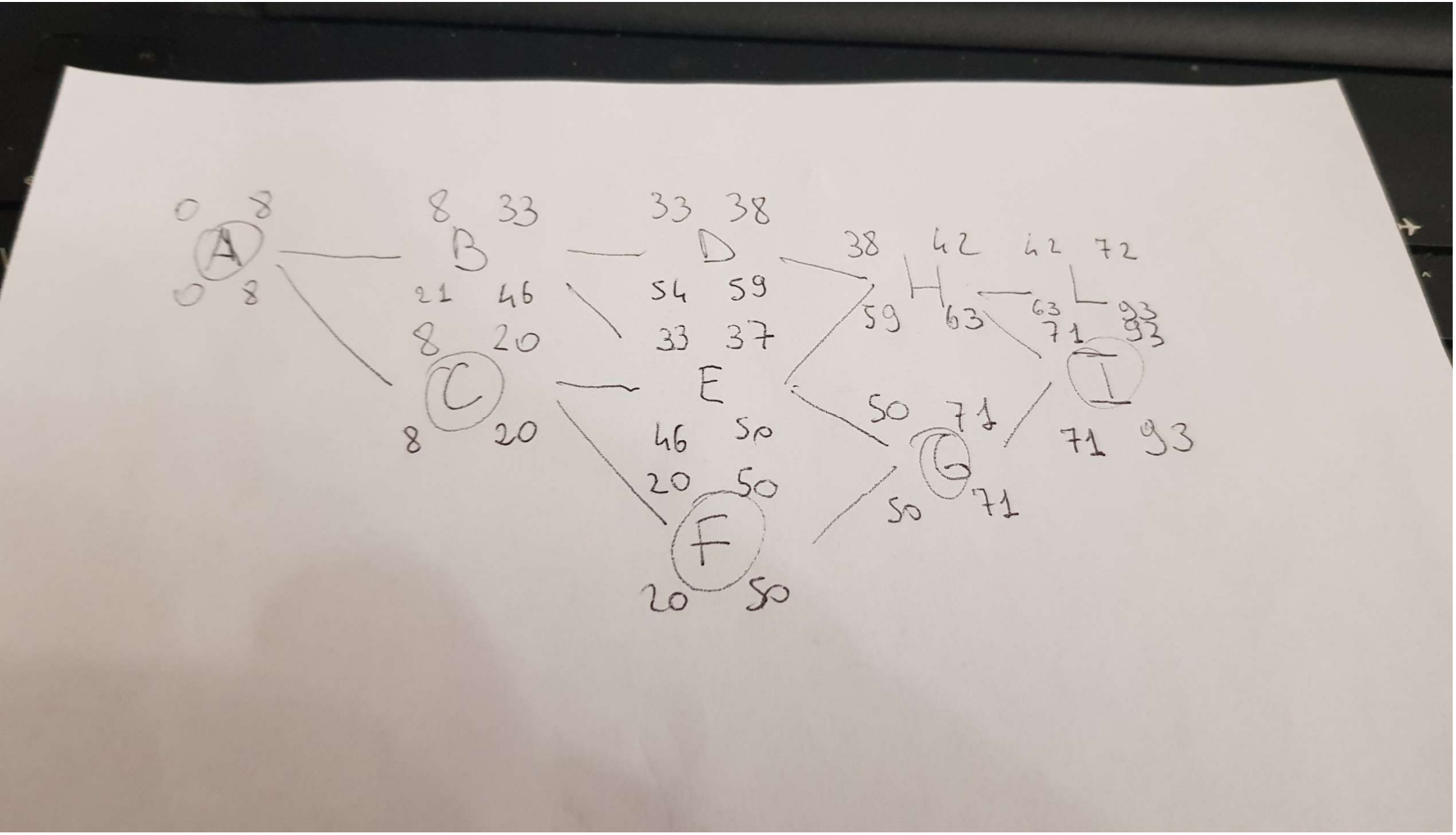
What is the critical path?

What is the value of both total slack and free slack?

What is the probability of ending the project in time?

Exercise 43

Z Value	Probability	*Z* Value	Probability
−3.0	.001	+0.0	.500
−2.8	.003	+0.2	.579
−2.6	.005	+0.4	.655
−2.4	.008	+0.6	.726
−2.2	.014	+0.8	.788
−2.0	.023	+1.0	.841
−1.8	.036	+1.2	.885
−1.6	.055	+1.4	.919
−1.4	.081	+1.6	.945
−1.2	.115	+1.8	.964
−1.0	.159	+2.0	.977
−0.8	.212	+2.2	.986
−0.6	.274	+2.4	.992
−0.4	.345	+2.6	.995
−0.2	.421	+2.8	.997


A
B
C
D
E
F
G
H
I
L
0 8
0 8
8 33
21 46
8 20
8 20
33 38
54 59
33 37
46 50
20 50
20 50
38 42
59 63
50 71
50 71
42 72
63 93
71 93
71 93

Exercise 43

		a	m	b	te	sigmate	varte	TOTAL SLACK	FREE SLACK
A	-	2	9	10	8	1,33	1,78	0	0
B	A	15	26	31	25	2,67	7,11	13	0
C	A	8	11	20	12	2,00	4,00	0	0
D	B	2	5	8	5	1,00	1,00	21	0
E	B, C	3	4	5	4	0,33	0,11	13	1
F	C	16	31	40	30	4,00	16,00	0	0
G	E, F	14	20	32	21	3,00	9,00	0	0
H	D, E	1	3	11	4	1,67	2,78	21	0
I	G, H	20	22	24	22	0,67	0,44	0	0
L	H	2	32	50	30	8,00	64,00	21	21

Critical PATH: A - C - F – G - I				
Te			sigma Te	
93			5.59	
			Z	
Ts			0.36	
95			P	
			0.64	

varTe = 1.78+4.00+16.00+9.00+0.44 =31.22

Sigma Te = 5.59

5.59*5.59=31.22

Z=2/5.59

Exercise 44

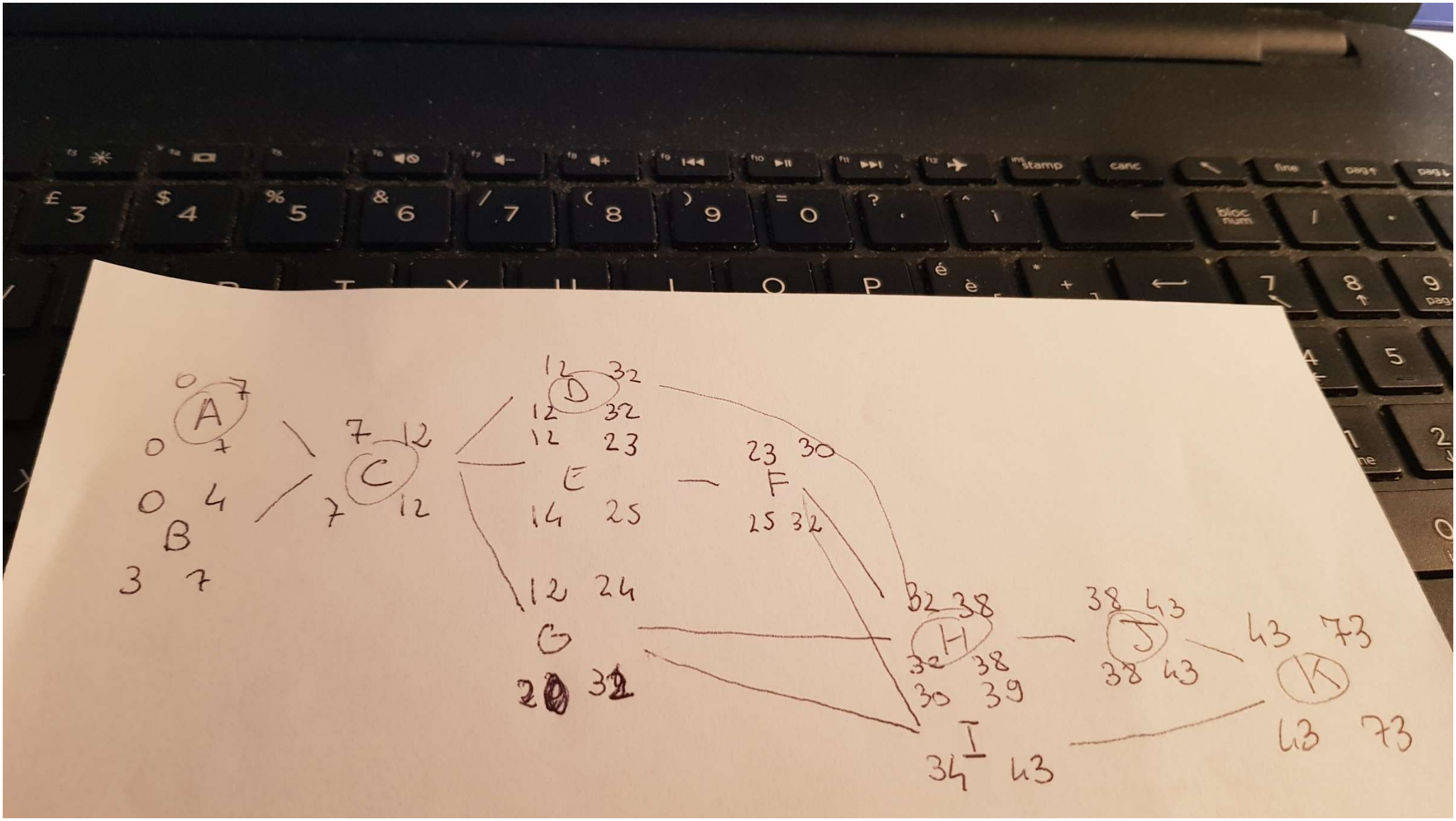
Activity	Predecessor	a	m	b
A	-	4	7	10
B	-	2	4	8
C	A,B	2	5	8
D	C	16	19	28
E	C	6	9	24
F	E	1	7	13
G	C	4	10	28
H	D,F,G,	2	5	14
I	G,F	5	8	17
J	H	2	5	8
K	I,J	17	29	45

Time required for completing the project: 100 days (T_S)

What is the probability of ending the project in time?

Exercise 44

Z Value	Probability	*Z* Value	Probability
−3.0	.001	+0.0	.500
−2.8	.003	+0.2	.579
−2.6	.005	+0.4	.655
−2.4	.008	+0.6	.726
−2.2	.014	+0.8	.788
−2.0	.023	+1.0	.841
−1.8	.036	+1.2	.885
−1.6	.055	+1.4	.919
−1.4	.081	+1.6	.945
−1.2	.115	+1.8	.964
−1.0	.159	+2.0	.977
−0.8	.212	+2.2	.986
−0.6	.274	+2.4	.992
−0.4	.345	+2.6	.995
−0.2	.421	+2.8	.997

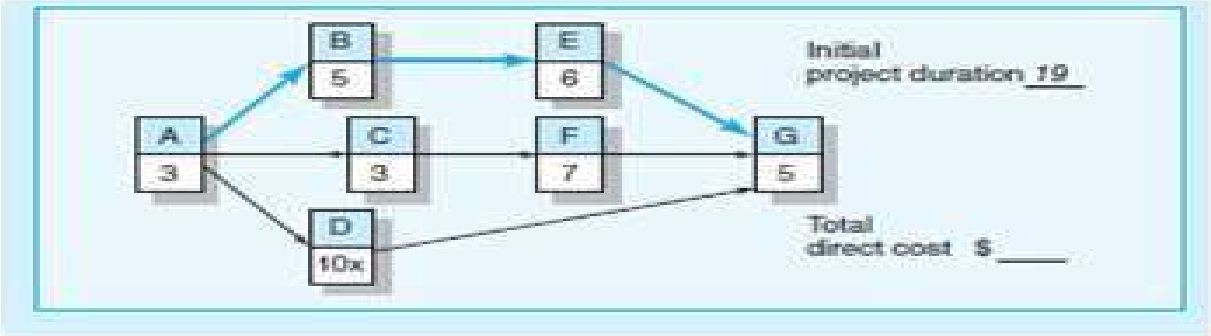

A
B
C
D
E
F
G
H
I
J
K

Exercise 44

Activity	Predecessor	a	m	b	te	sigmate	varte
A	-	4	7	10	7	1	1
B	-	2	4	8	4	1	1
C	A,B	2	5	8	5	1	1
D	C	16	19	28	20	2	4
E	C	6	9	24	11	3	9
F	E	1	7	13	7	2	4
G	C	4	10	28	12	4	16
H	D,F,G,	2	5	14	6	2	4
I	G,F	5	8	17	9	2	4
J	H	2	5	8	5	1	1
K	I,J	17	29	45	30	5	22

CRITICAL PATH A - C - D - H - J - K					
	TS	TE	VARTE	SIGMATE	Z
	100	73	33	5.73	4.72
PROBABILITY > 0.997					

Exercise 45



Activity	Crash Cost (Slope)	Maximum Crash Time	Normal Time	Normal Cost
A	$20	1	3	$50
B	$60	2	5	$60
C	$40	1	3	$70
D	$0	0	10	$50
E	$50	3	6	$100
F	$100	3	7	$90
G	$70	1	5	$50
		Total Direct Cost		**$470**

If the indirect costs for each project duration are 400$ (19 time units), 350$ (18 time units), 300$ (17 time units) and 250$ (16 time units), compute the total project cost for each duration. What is the optimum cost-time schedule for the project?

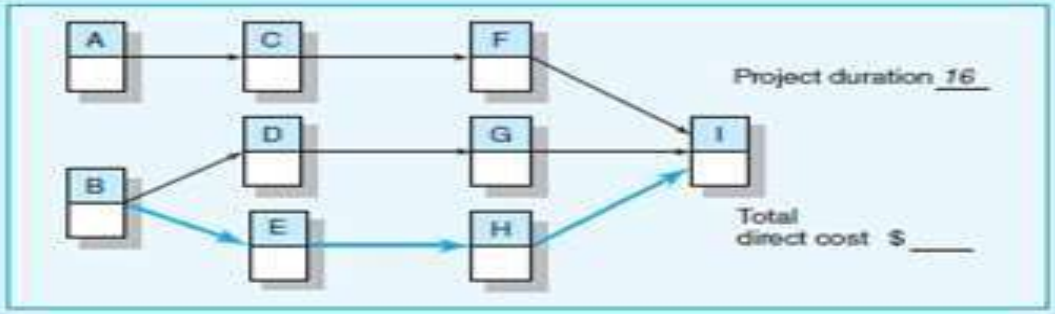
Exercise 45

			min
TIME UNITS	INDIRECT COSTS	DIRECT COSTS	TOTAL COSTS
16	250	610	860
17	300	540	840
18	350	490	840
19	400	470	870
CRITICAL PATH (19) A - B - E - G			
REDUCTION 1 TIME UNIT (A)			
REDUCTION 1 TIME UNIT (E)			
REDUCTION 1 TIME UNIT (G)			
OPTIMAL CHOICE 17 TIME UNITS			

Exercise 46

Act.	Crash Cost (Slope)	Maximum Crash Time	Normal Time	Normal Cost
A	10	1	4	30
B	70	2	7	60
C	0	0	1	80
D	20	2	4	40
E	50	3	5	110
F	200	3	5	90
G	30	1	2	60
H	40	1	2	70
I	0	0	2	140
				$680

Time unit = 1 week



If the indirect costs for each project duration are 1200$ (16 time units), 1130$ (15 time units), 1000$ (14 time units), 900$ (13 time units), 860$ (12 time units), 820$ (11 time units) and 790$ (10 time units) compute the total project cost for each duration. What is the optimum cost-time schedule for the project?

Exercise 46

			min
TIME UNITS	INDIRECT COSTS	DIRECT COSTS	TOTAL COSTS
16	1200	680	1880
15	1130	720	1850
14	1000	780	1780
13	900	850	1750
12	860	920	1780
11	820	1000	1820
10	790	1280	2070

CRITICAL PATH (16) B - E - H - I

REDUCTION 1 UNIT TIME (H)

REDUCTION 1 UNIT TIME (D + H)

REDUCTION 1 UNIT TIME (B)

REDUCTION 1 UNIT TIME (B)

REDUCTION 1 UNIT TIME (E + D + A)

REDUCTION 1 UNIT TIME (E + F + G)

Exercise 47

	Jan	Feb	Mar	Apr	May	Jun	BAC	%L
A	X	X					240	100%
B		X	X	X			240	50%
C			X	X	X	X	320	50%
D					X	X	200	0%
Tot							1000	

Time now = End March

	PV (planned cost)	AC (effective cost)	EV (earned value)
A	240	240	
B	160	100	
C	80	120	
D	0	0	

Exercise 47

	PV (planned cost)	AC (effective cost)	EV (earned value)
A	240	240	240
B	160	100	120
C	80	120	160
D	0	0	0
Tot	480	460	520

CV = EV – AC = 60
SV = EV – PV = 40
CPI = EV / AC = 1.13
SPI = 1.08
EAC = AC + (BAC-EV) = 940
EAC = AC + (BAC-EV)/CPI = 885
EAC = AC + (BAC-EV)/(CPI*SPI) = 853