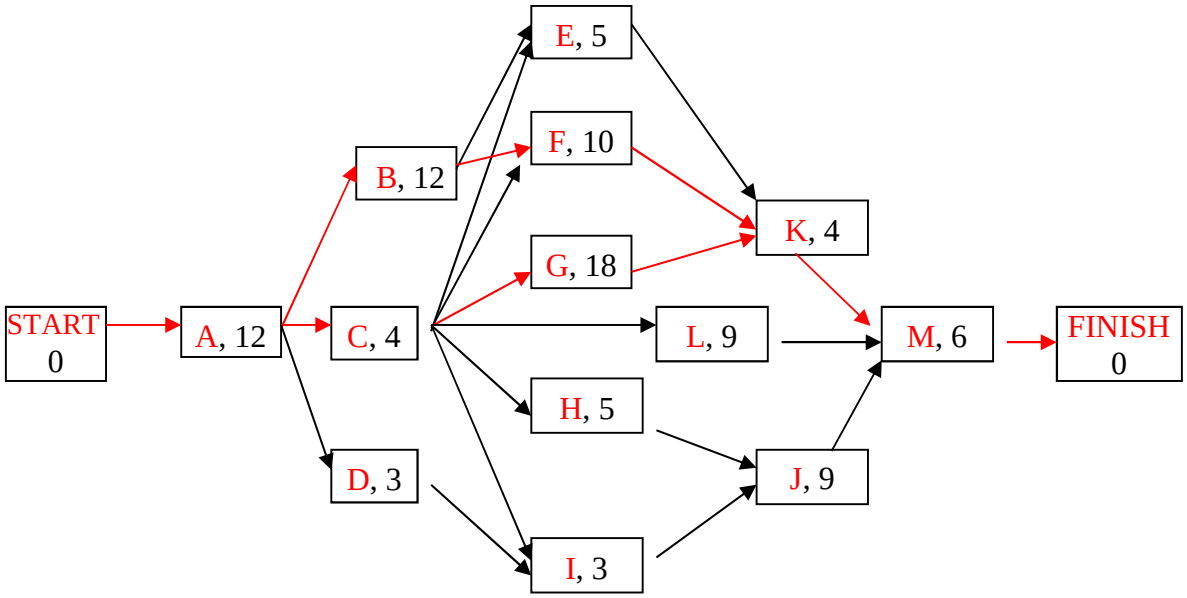
I.E. 2001 OPERATIONS RESEARCH

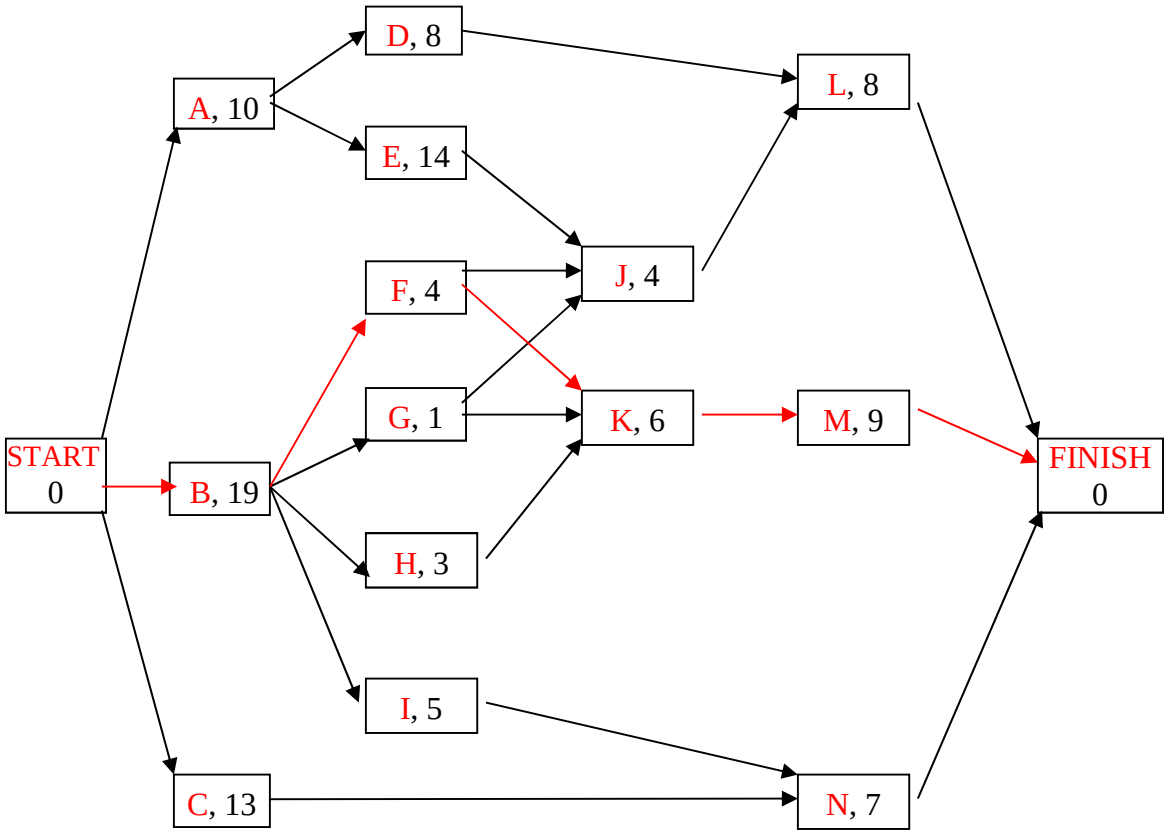
(Homework Assignment 11: Solutions)

Question 1.



By examining all possible paths from the Start to the Finish node, the longest path is given by *START-A-C-G-K-M-FINISH* or *START-A-B-F-K-M-FINISH*, each of which yields a total length of 44. All activities along these two paths are critical.

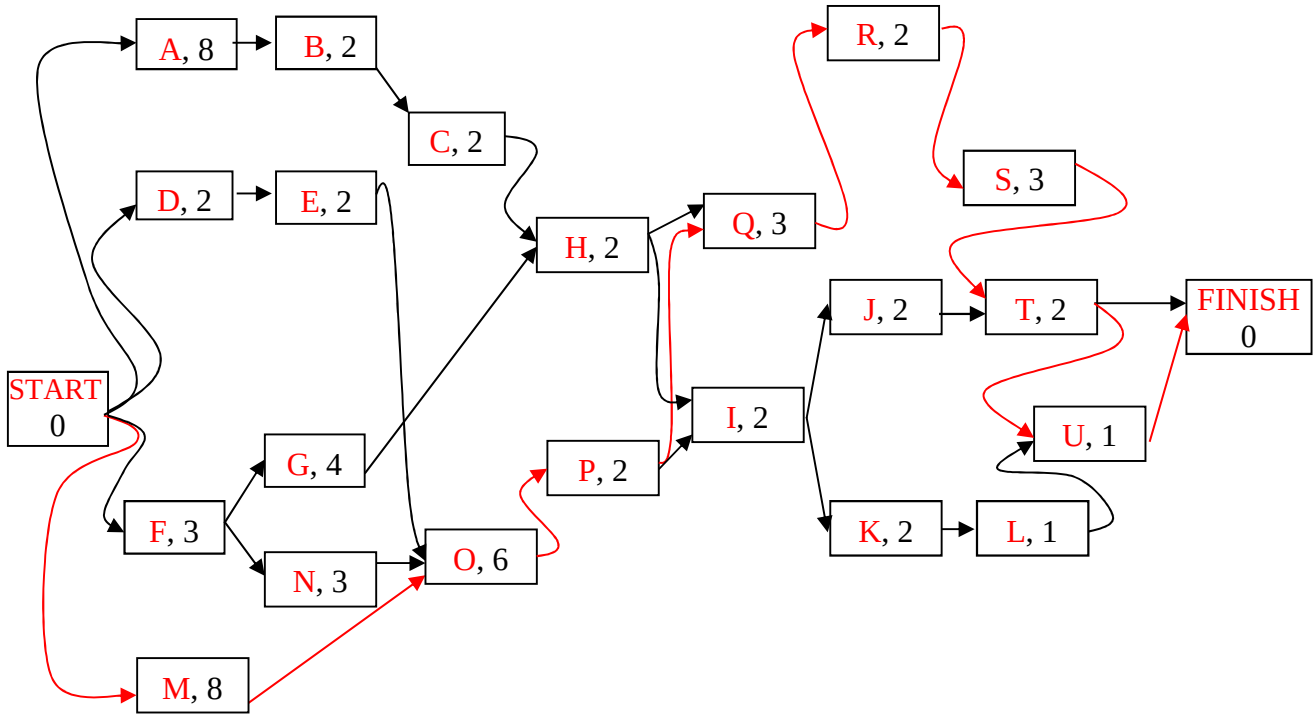
Question 2.



j, D_j	ES_j	LC_j	TF_j
START, 0	**0**	Min{12-10, 19-19, 31-13}= **0**	**0**
A, 10	0+0= **0**	Min{30-8, 26-14}= **12**	(12-0)-10 = **2**
B, 19	0+0= **0**	Min {23-4, 23-1, 23-3, 31-5} = **19**	(19-0)-19 = **0**
C, 13	0+0= **0**	38-7 = **31**	(31-0)-13 = **18**
D, 8	0+10= **10**	38-8 = **30**	(30-10)-8 = **12**
E, 14	0+10= **10**	30-4 = **26**	(26-10)-14 = **2**
F, 4	0+19= **19**	Min {29-6, 30-4} = **23**	(23-19)-4 = **0**
G, 1	0+19= **19**	Min {29-6, 30-4} = **23**	(23-19)-1 = **3**
H, 3	0+19= **19**	29-6 = **23**	(23-19)-3 = **1**
I, 5	0+19= **19**	38-7 = **31**	(31-19)-5 = **7**
J, 4	Max {10+14, 19+4, 19+1} = **24**	38-8 = **30**	(30-24)-4 = **2**
K, 6	Max {19+4, 19+1, 19+3} = **23**	38-9 = **29**	(29-23)-6 = **0**
L, 8	Max {10+8, 24+4} = **28**	38-0= **38**	(38-28)-8 = **2**
M, 9	23+6 = **29**	38-0= **38**	(38-29)-9 = **0**
N, 7	Max {19+5, 0+13} = **24**	38-0= **38**	(38-24)-7 = **7**
FINISH, 0	Max {27+8, 29+9, 24+7} = **38**	**38**	**0**

The forward and backward passes yield the ES and LC column values in the table above, from which we extract the total float for each activity and identify the critical ones as those that have zero total float (B,F,K,M). The minimum project duration is 38 days.

Question 3.
The network for this is shown below:



The forward and backward passes yield the ES and LC column values in the table above, from which we extract the total float for each activity.

J, D_j	***ES_j***	***LC_j***	***TF_j***
START, 0	**0**	Min{10-8, 6-2, 5-3, 8-8} = **0**	**0**
A, 8	0+0= **0**	12-2 = **10**	(10-0)-8 = **2**
B, 2	0+8= **8**	14-2 = **12**	(12-8)-2 = **2**
C, 2	8+2= **10**	16-2 = **14**	(14-10)-2 = **2**
D, 2	0+0= **0**	8-2 = **6**	(6-0)-2 = **4**
E, 2	0+2= **2**	14-6 = **8**	(8-2)-2 = **4**
F, 3	0+0= **0**	Min {14-4, 8-3} = **5**	(5-0)-3 = **2**
G, 4	0+3= **3**	16-2 = **14**	(14-3)-4 = **7**
H, 2	Max{10+2, 3+4} = **12**	Min {22-2, 19-3} = **16**	(16-12)-2 = **2**
I, 2	Max {12+2, 14+2} = **16**	Min{25-2, 24-2} = **22**	(22-16)-2 = **4**
J, 2	16+2 = **18**	26-2 = **24**	(24-18)-2 = **4**
K, 2	16+2 = **18**	26-1 = **25**	(25-18)-2 = **5**
L, 1	18+2 = **20**	27-1 = **26**	(26-20)-1 = **5**
M, 8	0+0= **0**	14-6 = **8**	(8-0)-8 = **0**
N, 3	0+3=**3**	14-6 = **8**	(8-3)-3 = **2**
O, 6	Max {2+2, 3+3, 0+8} = **8**	16-2 = **14**	(14-8)-6 = **0**
P, 2	8+6 = **14**	Min {22-2, 19-3} = **16**	(16-14)-2 = **0**
Q, 3	Max {12+2, 14+2} = **16**	21-2 = **19**	(19-16)-3 = **0**
R, 2	16+3 = **19**	24-3 = **21**	(21-19)-2 = **0**
S, 3	19+2 = **21**	26-2 = **24**	(24-21)-3 = **0**
T, 2	Max {21+3, 18+2} = **24**	Min {27-0, 27-1} = **26**	(26-24)-2 = **0**
U, 1	Max {24+2, 20+1} = **26**	27-0 = **27**	(27-26)-1 = **0**
FINISH, 0	Max {24+2, 26+1} = **27**	**27**	**0**

The critical activities are M,O,P,Q,R,S,T and U. The critical path method yields a minimum project duration of 27 days. Floats for noncritical activities are as given above...