

1.

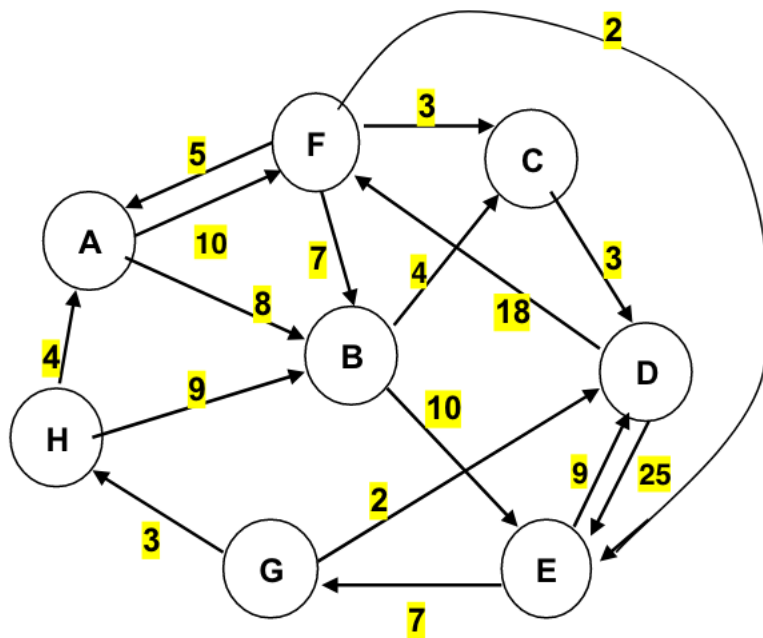
A) Find the shortest distance from G to C

Using the formula

maximize  $dt$

point of investigation to  $ds = 0$

$$dt - ds \leq \text{lst for edge } s \rightarrow t$$



Option 1: G to D to F to C: **23**

Option 2: G to D to F to B to C: **31**

Option 3: G to H to B to C: **16**

Option 4: G to H to A to F to B to C: **28**

Option 5: G to H to A to B to C: **19**

Option 6: G to H to A to F to C: **20**

We can see that Option 3: G to H to B to C: **16** has the shortest route

I also solved this using solver in Excel, below is the copied spread sheet. For part 2, I did the same thing. Spreadsheet is attached and different tabs are labeled to each problem

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	Node										
	A	B	C	D	E	F	G	H			
A	100	8	100	100	100	10	100	100		Total Distance	16
B	100	100	4	100	10	100	100	100			
C	100	100	100	3	100	100	100	100			
D	100	100	100	100	25	18	100	100			
E	100	100	100	9	100	100	7	100			
F	5	7	4	100	2	100	100	100			
G	100	100	100	2	100	100	100	3			
H	4	9	100	100	100	100	100	100			

Modify below for each problem

	Node									Total	Out-		
	A	B	C	D	E	F	G	H	Out	In	=		
A	0	0	0	0	0	0	0	0	0	0	=	0	
B	0	0	1	0	0	0	0	0	1	0	=	0	
C	0	0	0	0	0	0	0	0	0	-1	=	-1	
D	0	0	0	0	0	0	0	0	0	0	=	0	
E	0	0	0	0	0	0	0	0	0	0	=	0	
F	0	0	0	0	0	0	0	0	0	0	=	0	
G	0	0	0	0	0	0	0	1	1	1	=	1	
H	0	1	0	0	0	0	0	0	1	0	=	0	
Total in	0	1	1	0	0	0	0	1					

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Using above strategy for part B

G to:	Cost
A	7
B	12
C	16
D	2
E	19
F	17
G	N/A
H	3

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2)

First need to calculate cost be tie and profit (for objective function)

Type of Tie	Selling Price	Labor	Material	PPT
Silk=s	6.7	0.75	2.5	3.45
Poly=p	3.55	0.75	0.48	2.32
Blend1=n	4.31	0.75	0.75	2.81
Blend2=c	4.81	0.75	0.81	3.25

We use the last column to formulate  
 $\text{Max}(3.45X_1 + 2.32X_2 + 2.81X_3 + 3.25X_4)$

Problem was solved using excel and solver and is attached in the Problem 2 tab of included excel

s	p	b	c
7000	13687	13000	8500

Total benefit  
**120060**

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3)

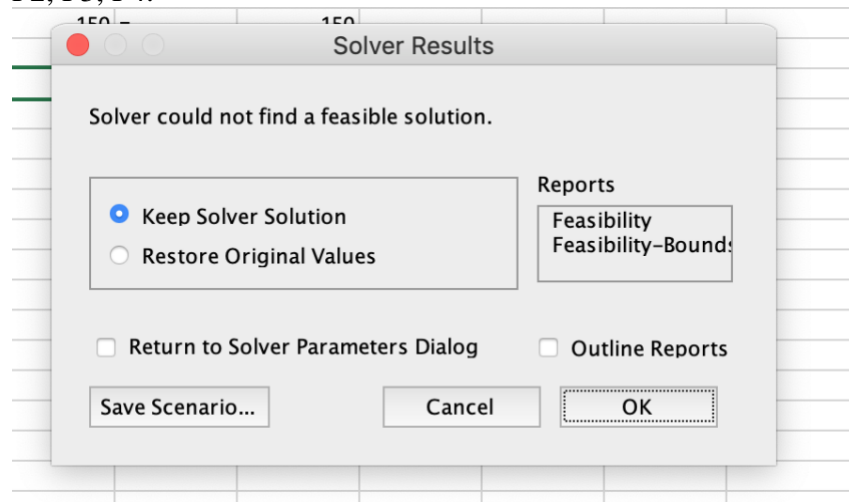
				CONSTRAINTS			
Start	End	Opt	Cost	Start	Cap	inequality	Supply/Demand
P1	W1	<b>150</b>	10	P1	150	=	150
P1	W2	<b>0</b>	15	P2	450	=	450
P2	W1	<b>200</b>	11	P3	250	=	250
P2	W2	<b>250</b>	8	P4	150	=	150
P3	W1	<b>0</b>	13	W1	0	=	0
P3	W2	<b>150</b>	8	W2	0	=	0
P3	W3	<b>100</b>	9	W3	0	=	0
P4	W2	<b>0</b>	14	R1	-100	=	-100
P4	W3	<b>150</b>	8	R2	-150	=	-150
W1	R1	<b>100</b>	5	R3	-100	=	-100
W1	R2	<b>150</b>	6	R4	-200	=	-200
W1	R3	<b>100</b>	7	R5	-200	=	-200
W1	R4	<b>0</b>	10	R6	-150	=	-150
W2	R3	<b>0</b>	12	R7	-100	=	-100
W2	R4	<b>200</b>	8				
W2	R5	<b>200</b>	10	Total Cost	<b>17,100</b>		
W2	R6	<b>0</b>	14				
W3	R4	<b>0</b>	14				
W3	R5	<b>0</b>	12				
W3	R6	<b>150</b>	12				
W3	R7	<b>100</b>	6				

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Part 2) When the equation is edited for account for no warehouse 2, solver cannot find a solution. The program bottlenecks are the warehouse solution. Warehouse 2 is critical as it connects to P1, P2, P3, P4.



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Part 3

Yes, you can do it but it will cost more. You need to add two limits, so that the the total transfer in and out of w2 is less than 100 for each

				CONSTRAINTS			
Start	End	N	Cost	Start	Cap	inequality	Supply/Demand
P1	W1	150	10	P1	150	=	150
P1	W2	0	15	P2	450	=	450
P2	W1	350	11	P3	250	=	250
P2	W2	100	8	P4	150	=	150
P3	W1	0	13	W1	0	=	0
P3	W2	0	8	W2	0	=	0
P3	W3	250	9	W3	0	=	0
P4	W2	0	14	R1	-100	=	-100
P4	W3	150	8	R2	-150	=	-150
W1	R1	100	5	R3	-100	=	-100
W1	R2	150	6	R4	-200	=	-200
W1	R3	100	7	R5	-200	=	-200
W1	R4	150	10	R6	-150	=	-150
W2	R3	0	12	R7	-100	=	-100
W2	R4	50	8				
				Total			
W2	R5	50	10	Cost	18300		
W2	R6	0	14				
W3	R4	0	14	Limit warehouse			
W3	R5	150	12	w2	100	<=	100 input
W3	R6	150	12	W2	100	<=	100 out
W3	R7	100	6				

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4) Work is in attached excel spread sheet, results are summarized below  
for part A)

Coin Value	1	5	10	25	Change	
Count						202
amount	2	0	0	8	Desired	
						202
					Total Coins	
						10

It takes 10 coins 2 at value 1 and 8 at value 25.

Coin Value	1	3	7	12	27	Change	
Count							293
amount	0	0	2	3	9	Desired	
							293
						Total Coins	
							14

It takes 14 coins 9 at value 27, 3 at value 11, 2 at value 7.