Optimization Method HW6
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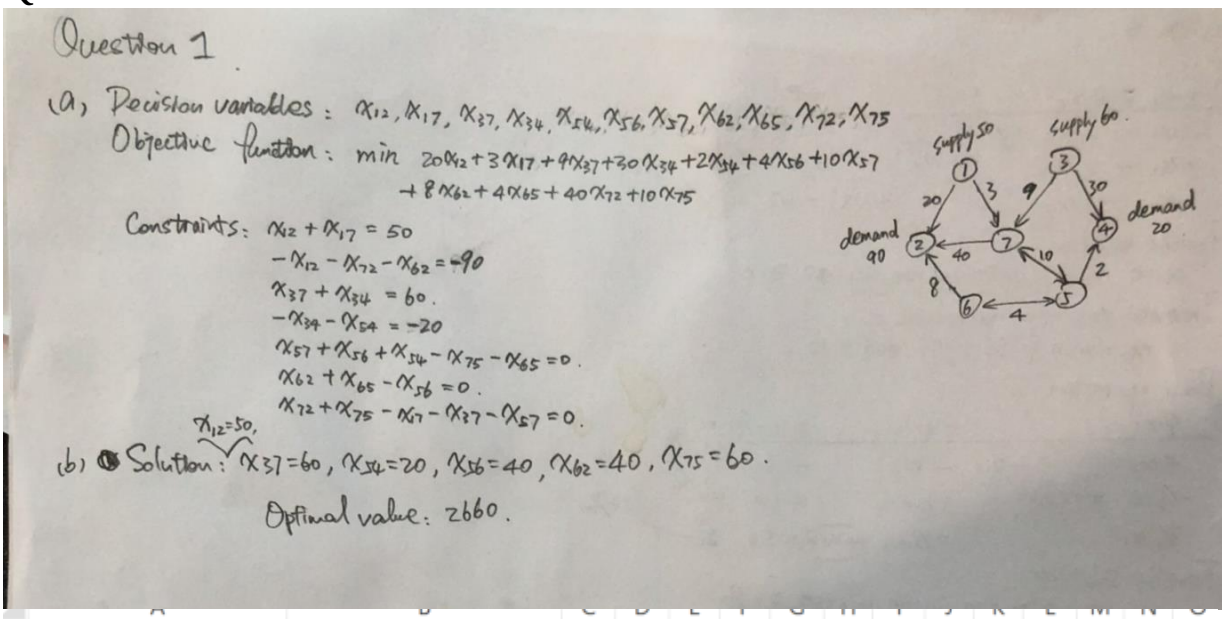
Question 1:



Question 1

(a) Decision variables: $x_{12}, x_{17}, x_{37}, x_{34}, x_{54}, x_{56}, x_{57}, x_{62}, x_{65}, x_{72}, x_{75}$

Objective function: $\min\ 20x_{12}+3x_{17}+9x_{37}+30x_{34}+2x_{54}+4x_{56}+10x_{57}+8x_{62}+4x_{65}+40x_{72}+10x_{75}$

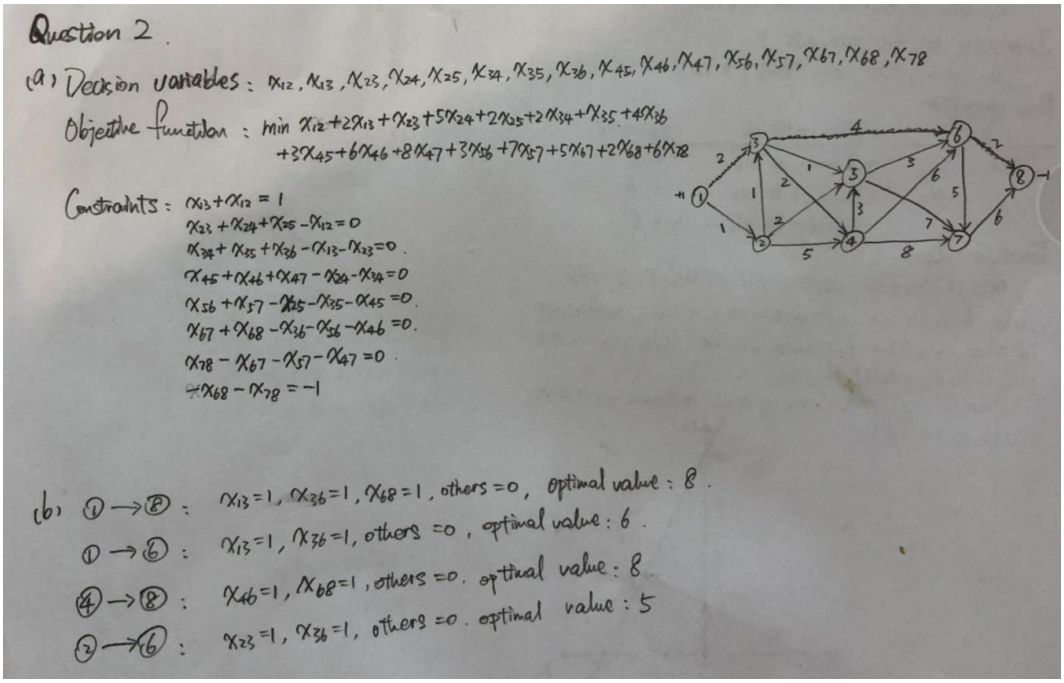
Constraints:
$x_{12}+x_{17}=50$
$-x_{12}-x_{72}-x_{62}=-90$
$x_{37}+x_{34}=60$.
$-x_{34}-x_{54}=-20$
$x_{57}+x_{56}+x_{54}-x_{75}-x_{65}=0$.
$x_{62}+x_{65}-x_{56}=0$.
$x_{72}+x_{75}-x_{17}-x_{37}-x_{57}=0$.

(b) Solution: $x_{12}=50$, $x_{37}=60$, $x_{34}=20$, $x_{56}=40$, $x_{62}=40$, $x_{75}=60$.

Optimal value: 2660.

HW 6											
Question 1											
	x12	x17	x37	x34	x54	x56	x57	x62	x65	x72	x75
	50	0	60	0	20	40	0	40	0	0	60
objective:	=20*B4+3*C4+9*D4+30*E4+2*F4+4*G4+10*H4+8*I4+4*J4+40*K4+10*L4										
contraints:	=B4+C4	=	50								
	=-B4-K4-I4	=	-90								
	=D4+E4	=	60								
	=-E4-F4	=	-20								
	=H4+G4+F4-L4-J4	=	0								
	=I4+J4-G4	=	0								
	=K4+L4-C4-D4-H4	=	0								

Question 2:



Question 2.

(a) Decision variables: $x_{12}, x_{13}, x_{23}, x_{24}, x_{25}, x_{34}, x_{35}, x_{36}, x_{45}, x_{46}, x_{47}, x_{56}, x_{57}, x_{67}, x_{68}, x_{78}$

Objective function: $\min x_{12}+2x_{13}+x_{23}+5x_{24}+2x_{25}+2x_{34}+x_{35}+4x_{36}+3x_{45}+6x_{46}+8x_{47}+3x_{56}+7x_{57}+5x_{67}+2x_{68}+6x_{78}$

Constraints:

$x_{13}+x_{12}=1$

$x_{23}+x_{24}+x_{25}-x_{12}=0$

$x_{34}+x_{35}+x_{36}-x_{13}-x_{23}=0$

$x_{45}+x_{46}+x_{47}-x_{24}-x_{34}=0$

$x_{56}+x_{57}-x_{25}-x_{35}-x_{45}=0$

$x_{67}+x_{68}-x_{36}-x_{56}-x_{46}=0$

$x_{78}-x_{67}-x_{57}-x_{47}=0$

$-x_{68}-x_{78}=-1$

(b) ① → ⑧ : $x_{13}=1, x_{36}=1, x_{68}=1$, others $=0$, optimal value : 8.

① → ⑥ : $x_{13}=1, x_{36}=1$, others $=0$, optimal value : 6.

④ → ⑧ : $x_{46}=1, x_{68}=1$, others $=0$. optimal value : 8.

② → ⑥ : $x_{23}=1, x_{36}=1$, others $=0$. optimal value : 5

Node 1 -> Node 8:

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Question 2																
	x12	x13	x23	x24	x25	x34	x35	x36	x45	x46	x47	x56	x57	x67	x68	x78
	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0
objective	=B22+2*C22+D22+5*E22+2*F22+2*G22+H22+4*I22+3*J22+6*K22+8*L22+3*M22+7*N22+5*O22+2*P22+6*Q22															
constraints:	=B22+C22		=	1												
	=D22+E22+F22-B22		=	0												
	=G22+H22+I22-C22-D22		=	0												
	=J22+K22+L22-E22-G22		=	0												
	=M22+N22-F22-H22-J22		=	0												
	=O22+P22-I22-K22-M22		=	0												
	=Q22-L22-N22-O22		=	0												
	=-P22-Q22		=	-1												

Node 1 -> Node 6:

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Question 2																
	x12	x13	x23	x24	x25	x34	x35	x36	x45	x46	x47	x56	x57	x67	x68	x78
	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
objective	=B22+2*C22+D22+5*E22+2*F22+2*G22+H22+4*I22+3*J22+6*K22+8*L22+3*M22+7*N22+5*O22+2*P22+6*Q22															
constraints:	=B22+C22		=	1												
	=D22+E22+F22-B22		=	0												
	=G22+H22+I22-C22-D22		=	0												
	=J22+K22+L22-E22-G22		=	0												
	=M22+N22-F22-H22-J22		=	0												
	=O22+P22-I22-K22-M22		=	-1												
	=Q22-L22-N22-O22		=	0												
	=-P22-Q22		=	0												

Node 4 -> Node 8:

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Question 2																
	x12	x13	x23	x24	x25	x34	x35	x36	x45	x46	x47	x56	x57	x67	x68	x78
	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
objective	=B22+2*C22+D22+5*E22+2*F22+2*G22+H22+4*I22+3*J22+6*K22+8*L22+3*M22+7*N22+5*O22+2*P22+6*Q22															
constraints:	=B22+C22		=	0												
	=D22+E22+F22-B22		=	0												
	=G22+H22+I22-C22-D22		=	0												
	=J22+K22+L22-E22-G22		=	1												
	=M22+N22-F22-H22-J22		=	0												
	=O22+P22-I22-K22-M22		=	0												
	=Q22-L22-N22-O22		=	0												
	=-P22-Q22		=	-1												

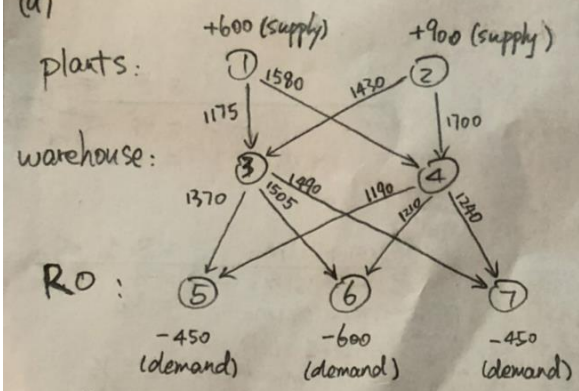
Node 2 -> Node 6:

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Question 2																
	x12	x13	x23	x24	x25	x34	x35	x36	x45	x46	x47	x56	x57	x67	x68	x78
	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
objective	=B22+2*C22+D22+5*E22+2*F22+2*G22+H22+4*I22+3*J22+6*K22+8*L22+3*M22+7*N22+5*O22+2*P22+6*Q22															
constraints:	=B22+C22		=	0												
	=D22+E22+F22-B22		=	1												
	=G22+H22+I22-C22-D22		=	0												
	=J22+K22+L22-E22-G22		=	0												
	=M22+N22-F22-H22-J22		=	0												
	=O22+P22-I22-K22-M22		=	-1												
	=Q22-L22-N22-O22		=	0												
	=-P22-Q22		=	0												

Question 3:

Question 3.

(a)



(Note: ③ and ④ are neither supply nor demand nodes.)

(b)

Decision variable: $x_{13}, x_{14}, x_{23}, x_{24}, x_{35}, x_{36}, x_{37}, x_{45}, x_{46}, x_{47}$

Objective value: $\min 1175x_{13} + 1580x_{14} + 1430x_{23} + 1700x_{24} + 1370x_{35} + 1505x_{36} + 1490x_{37} + 1190x_{45} + 1210x_{46} + 1240x_{47}$

Constraints:

$x_{13} + x_{14} = 600$

$x_{23} + x_{24} = 900$

$x_{35} + x_{36} + x_{37} - x_{13} - x_{23} = 0$

$x_{45} + x_{46} + x_{47} - x_{14} - x_{24} = 0$

$-x_{35} - x_{45} = -450$

$-x_{36} - x_{46} = -600$

$-x_{37} - x_{47} = -450$

$x_{13} \le 375, x_{14} \le 450, x_{23} \le 525, x_{24} \le 600$

$x_{35} \le 300, x_{36} \le 450, x_{37} \le 300$

$x_{45} \le 375, x_{46} \le 450, x_{47} \le 225$

(c) Solution:

$x_{13} = 375$

$x_{14} = 225$

$x_{23} = 375$

$x_{24} = 525$

$x_{35} = 300$

$x_{36} = 150$

$x_{37} = 300$

$x_{45} = 150$

$x_{46} = 450$

$x_{47} = 150.$

optimal value:

4217625

	B	C	D	E	F	G	H	I	J	K
Question 3										
	x13	x14	x23	x24	x35	x36	x37	x45	x46	x47
	375	225	375	525	300	150	300	150	450	150
objective	=1175*B39+1580*C39+1430*D39+1700*E39+1370*F39+1505*G39+1490*H39+1190*I39+1210*J39+1240*K39									
constraints:	=B39+C39	=	600							
	=D39+E39	=	900							
	=F39+G39+H39-B39-D39	=	0							
	=I39+J39+K39-C39-E39	=	0							
	=-F39-I39	=	-450							
	=-G39-J39	=	-600							
	=-H39-K39	=	-450							
	=B39	<=	375							
	=C39	<=	450							
	=D39	<=	525							
	=E39	<=	600							
	=F39	<=	300							
	=G39	<=	450							
	=H39	<=	300							
	=I39	<=	375							
	=J39	<=	450							
	=K39	<=	225							