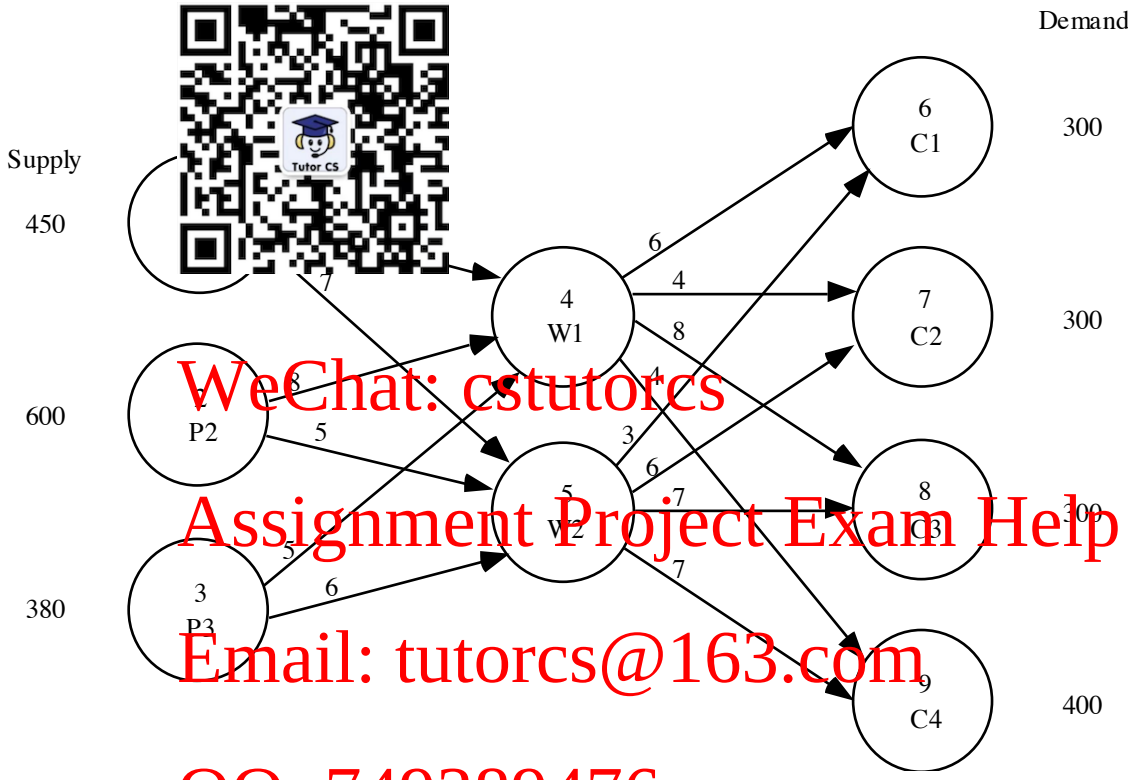
17. a. Network Model



b. & c.

The linear programming formulation and solution are shown.


```
LINEAR PROGRAMMING PROBLEM

MIN 4X14 + 7X15 + 8X24 + 5X25 + 5X34 + 6X35 + 6X46 + 4X47 + 8X48 + 4X49 +
3X56 + 6X57 + 7X58 + 7X59

     S.T.

        1)  X14 + X15 <= 450
        2)  X24 + X25 <= 600
        3)  X34 + X35 < 380
        4)  X46 + X47 + X48 + X49 - X14 - X24 - X34 = 0
        5)  X56 + X57 + X58 + X59 - X15 - X25 - X35 = 0
        6)  X46 + X56 = 300
        7)  X47 + X57 = 300
        8)  X48 + X58 = 300
        9)  X49 + X59 = 400
```

OPTIMAL SOLUTION

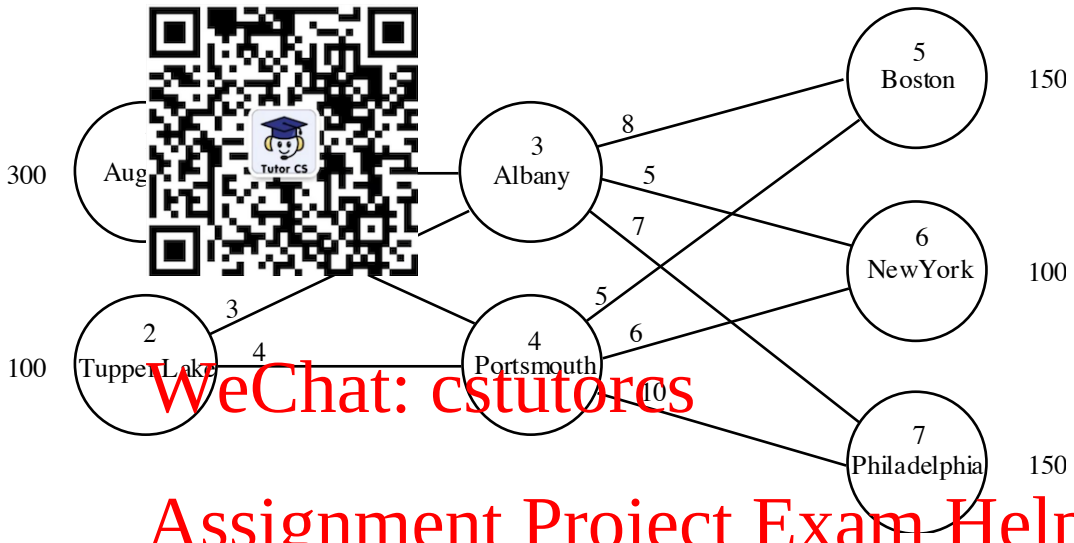
Value

	Value	Reduced Cost
	450.00000	0.00000
	0.00000	2.00000
X24	0.00000	4.00000
X25	600.00000	0.00000
X34	250.00000	0.00000
X35	0.00000	0.00000
X46	0.00000	2.00000
X47	300.00000	0.00000
X48	0.00000	0.00000
X49	400.00000	0.00000
X56	300.00000	0.00000
X57	0.00000	3.00000
X58	300.00000	0.00000
X59	0.00000	4.00000

Constraint	Slack/Surplus	Dual Value
1	0.00000	-1.00000
2	0.00000	-1.00000
3	130.00000	0.00000
4	0.00000	9.00000
5	0.00000	9.00000
6	0.00000	13.00000
7	0.00000	9.00000
8	0.00000	5.00000
9	0.00000	6.00000

There is an excess capacity of 130 units at plant 3.

19. a.



b.

$$\text{Min } 7x_{13} + 5x_{14} + 3x_{23} + 4x_{24} + 8x_{35} + 5x_{36} + 7x_{37} + 5x_{45} + 6x_{46} + 10x_{47}$$

s.t.

$$\begin{aligned}
x_{13} + x_{14} &\le 300\\
x_{23} + x_{24} &\le 100\\
-x_{13} - x_{23} + x_{35} + x_{36} + x_{37} &= 0\\
-x_{14} - x_{24} + x_{45} + x_{46} + x_{47} &= 0\\
x_{35} + x_{45} &= 150\\
x_{36} + x_{46} &= 100\\
x_{37} + x_{47} &= 150
\end{aligned}$$

$x_{ij} \ge 0$ for all i and j

c. Optimal Solution:

Variable	Value
x_{13}	50
x_{14}	250
x_{23}	100
x_{24}	0
x_{35}	0
x_{36}	0
x_{37}	150
x_{45}	150
x_{46}	100
x_{47}	0

Objective Function: 4300