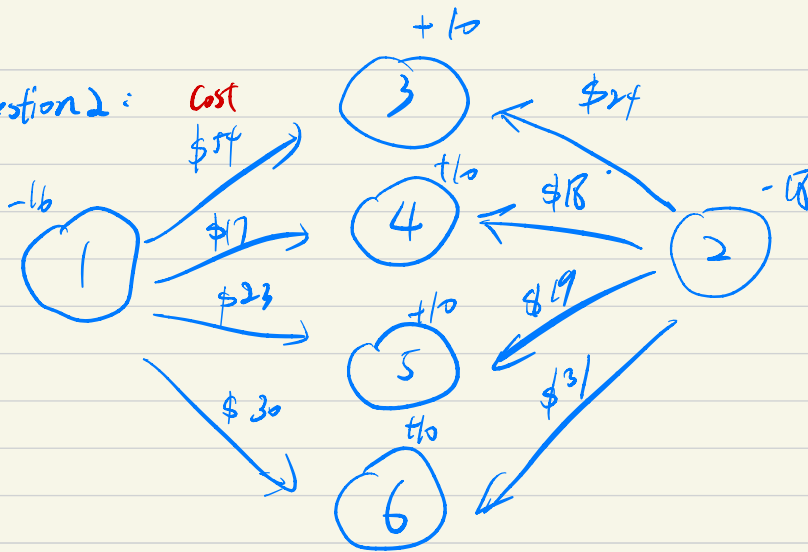# Question 1:

Define X_1: number of Hyperlink
X_2: number of Fastlink
X_3: number of Speedlink
y_4: number of Microlink
X_5: number of Etherlink.

$$(189-136)X_1 + (149-101)X_2 + (129-96)X_3 + (169-137)X_4 + (139-101)X_5$$

Obj   Max: $53X_1 + 48X_2 + 33X_3 + 32X_4 + 38X_5$

S.t.
$$20X_1 + 15X_2 + 10X_3 + 8X_4 + 5X_5 \leq 80,000$$
$$28X_1 + 24X_2 + 18X_3 + 12X_4 + 16X_5 \leq 10,0000$$
$$8X_1 + 8X_2 + 4X_3 + 4X_4 + 6X_5 \leq 30,000$$
$$0.75X_1 + 0.6X_2 + 0.5X_3 + 0.45X_4 + X_5 \leq 5,000$$
$$X_1, X_2, X_3, X_4, X_5 \geq 500$$
$$2X_1 \leq X_2$$

Question 2: Cost

Diagram labels:
- Node 3: +10, $24
- Node 1: -16, $54, $17, $23, $30
- Node 4: +10, $18
- Node 2: -18, $19
- Node 5: +10, $31
- Node 6: +10

$G(V, E)$

6 nodes: $V = [1, 2, 3, 4, 5, 6]$

8 edges: $E = [(1,3), (1,4), \cdots]$

$\forall (i, N) \in E$

define X_{ij} is the number of flow, C_{ij} is the cost

Obj:

$$\text{Min} \sum_{(i,j) \in E} C_{ij} X_{ij}$$

s.t

$5 \le X_{13} + X_{23} \le 10 \quad$ node 3

$5 \le X_{14} + X_{24} \le 10 \quad$ node 4

$5 \le X_{15} + X_{25} \le 10 \quad$ node 5
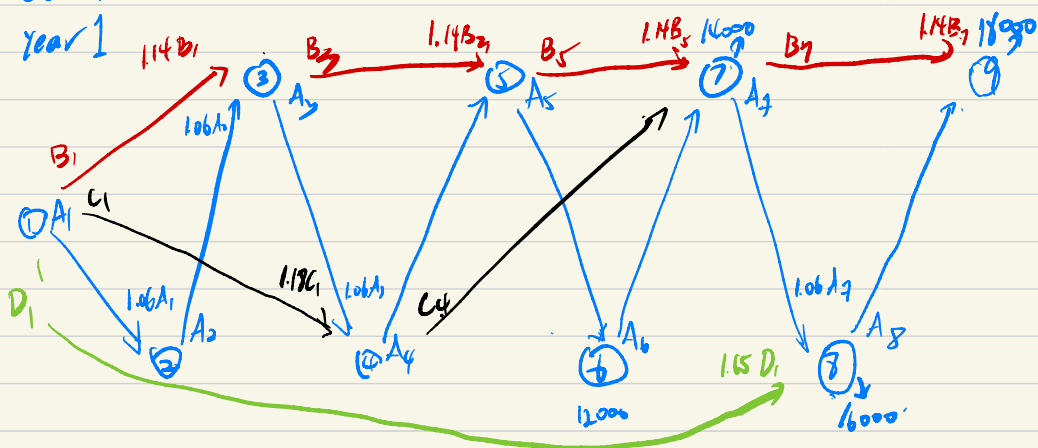
$5 \le X_{16} + X_{26} \le 10 \quad$ node 6

$X_{13} + X_{14} + X_{15} + X_{16} \le 16$

$X_{23} + X_{24} + X_{25} + X_{26} \le 18$

$X_{ij} \ge 0$

Question 3:

year 1

Define: A_i = Amount of \$ invest in A at the beg of year i $(i = 1, \cdots 8)$

B_i = " " B " for j $(1,3,5,7)$

C_i = " " C " for k $(1,4)$

D_i = " " D " for $l = 1$

Obj Min: $A_1 + B_1 + C_1 + D_1$

S.t :
$$1.06 A_1 = A_2$$
$$1.06 A_2 + 1.14 B_1 = A_3 + B_3$$
$$1.06 A_3 + 1.18 C_1 = A_4 + C_4$$
$$1.06 A_4 + 1.14 B_3 = A_5 + B_5$$
$$1.06 A_5 = A_6 + 12000$$
$$1.06 A_6 + 1.14 B_5 + 1.19 C_4 = A_7 + B_7 + 14000$$
$$1.06 A_7 + 1.65 D_1 = A_8 + 16000$$
$$1.06 A_8 + 1.14 B_7 = 18000$$

$$A_1, B_1 + C_1 + D_1 \geq 0$$