Problem 1

a) **(smaller)**
According to the bull whip effect, small changes in demand are exaggerated going up the supply chain. The order information is passed from the retailer to the factory along the supply chain, so the demand variation at the factory is greater than that at the retailer.

b) **(EOQ)(EMQ)…(total costs)**
EOQ /EMQ models are used to minimize the overall costs, including ordering/setup costs and inventory holding costs.

c) **(sometimes)…(>=)**
We increase the batch size of the i^{th} product in order that the external setup of the $\{i+1\}^{th}$ product can be finished when processing one batch of i^{th} product. But this does not necessarily give the minimal batch size which can meet the demand, as seen from the homework.

Problem 3

$Y(n) = Kn^{-a}$
$K = Y(1) = 10$
$2^{-a} = Y(2n)/Y(n) = Y(2)/Y(1) = Y(4)/Y(2) = 0.8 \Rightarrow a = -\log_2 0.8 = 0.3219$
$Y(6) = K(6)^{-a} = 10(6)^{-0.3219} = 5.62$ hrs

Problem 4

n	D_n	S_{n-1}
1	2500	=(2500+2600+2800+2400)/4=2575
2	2600	=(0.1)(2500)+(0.9)(2575)=2567.5
3	2800	=(0.1)(2600)+(0.9)(2567.5)=2570.75
4	2400	=(0.1)(2800)+(0.9)(2570.75)=2593.68
5		=(0.1)(2400)+(0.9)(2593.68)=2574.31

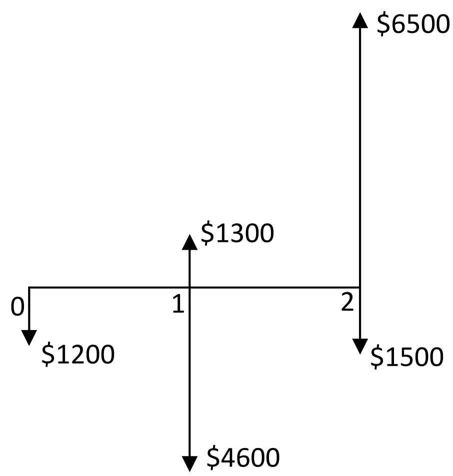
So the demand forecast for 2009 is 2574.

Problem 5

P = -\$1200 + (-\$4600 + \$1300)(P/F, 18%, 1) + (-\$1500 + \$6500)(P/F, 18%, 2)

= -\$1200 + (-\$3300)(0.8475) + (\$5000)(0.7182)

= -\$405.75

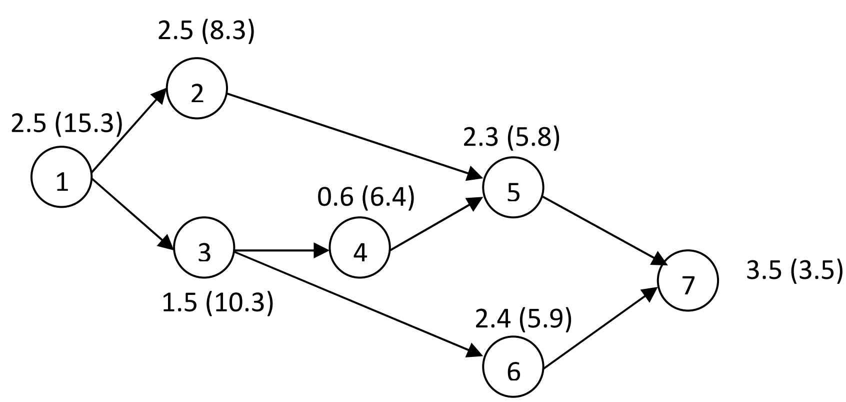


Problem 6

a) $\tau = \frac{1}{D} = \frac{50\ wk/yr\ \cdot 40\ hr/wk}{24000\ unit/yr} = \frac{1}{12}\ hr/unit = 5\ min/unit$

b) Total work time = (2.5+2.5+1.5+0.6+2.3+2.4+3.5)min = 15.3 min, so the lower bound of the station number is given by $\lceil 15.3/5 \rceil = \lceil 3.06 \rceil = 4$

c)



Rank: 1 -> 3 -> 2 -> 4 -> 6 -> 5 -> 7

Stations	**Total Task Time (min)**
1, 3, 4	4.6
2, 6	4.9
5	2.3
7	3.5

Problem 7

M = $1.50/unit
C = $8.00/unit
v = C-M = $6.5/unit
s = 60 min = 1/10/250 yr = 1/2500 yr
A = $50.00
p = 5 min = 5/60/10/250 yr = 1/30000 yr
w = 1/40% = 2.5
i = 0.75/yr
D = 8000 unit/yr

a) h_{wip} = i(M+v/2) = (.75/yr)($1.50+$6.5/2)/unit = $3.56/unit/yr
b) Using the EMQ formula

$$Q^* = \sqrt{\frac{2AD}{i\left[(M+v)+2pwD\left(M+\frac{v}{2}\right)\right]}} = 272.80\ unit/batch$$

Compare the total cost for Q = 272 unit/batch and Q = 273 unit/batch:
When Q = 272 unit/batch, total cost is $14961.088;
When Q = 273 unit/batch, total cost is $14961.076.
So Q* = 273 unit/batch.

Problem 8

Using little's law,

$$Throughput\ Time = \frac{Average\ Inventory}{Sales\ Rate} = \frac{4\ batch}{(3\ batch)/\ (8\ hr)} = \frac{32}{3}hr = 10hr\ 40min$$