Question 1

$P = [A, B, C]$

$M = [1, 2]$

$j \in P \quad i \in M$ Define X_{ij} = number of units for product of j in machine i

$$Y_{ij} = \begin{cases} 1 & \text{Product } j - \text{product on machine } i \\ 0 & \text{o.w.} \end{cases}$$

C_{ij} : cost of producing

T_{ij} : Time of producing

S_{ij} : setup cost

$j \in P \quad D_j$: Demand , $i \in M \quad m_i$ = Machine Time

$$\text{Min} : \sum_{i \in M} \sum_{j \in P} C_{ij} X_{ij} + S_{ij} Y_{ij}$$

S.t $\forall j \in P$

$$\sum_{i \in M} X_{ij} = D_j$$

$\forall i \in M$

$$\sum_{j \in P} T_{ij} X_{ij} \leq m_i$$

$\forall i \in M \quad j \in M$

$$X_{ij} \leq D_j Y_{ij}$$

Question 2

$S = [1, 2, 3, 4]$ $R = [1, 2, 3, 4]$

$i \in S$ Define $Y_i = \begin{cases} 1 \\ 0 \end{cases}$

C_i = Cost per Barrel

T_i = Tract Cost

A_i = Barrel Available

$i \in S \quad j \in R \qquad P_{ij}$ = Production per Barrel

X_{ij} = Number of Barrel

$j \in R \qquad D_j$ = Demand

$$\text{Min} \quad \sum_{i \in S}\sum_{j \in R} C_i X_{ij} + \sum_{i \in S} T_i Y_i$$

$$\text{s.t.} \quad \sum_{i \in S}^{j \in R} P_{ij} X_{ij} \geq D_j$$

$$\sum_{j \in R}^{i \in S} X_{ij} \leq A_i Y_i \qquad \sum_{j \in R}^{i \in S} X_{ij} \geq 500 Y_i$$

Question 3

$W = [1, 2, 3, 4]$

$i \in W$ Define B_i : beginning inventory in week i

               N_i number of batch orders in week i.

               E_i number of inventory end up in week i

               D_i demand in week i

               $Y_i = \begin{cases} 1 & \text{if order is made in week } i \\ 0 \end{cases}$

$i \in W$

Min $125 \sum_{i \in W} N_i + 50 \sum_{i \in W} Y_i + 15 \sum_{i \in W} E_i / 100$

st. $i \in W$

     $B_i = E_{i-1}$

     $E_i = B_i + 100 N_i - D_i$

     $N_i \leq M Y_i$

     $B_1 = 0$