(Jeans) Every year, a jeans manufacturing company faces the following quarterly demand which must be met on time of 4000, 7000, 8000, and 3000 respectively. Due to the seasonality factor of demand, coupled with a strong labor union, employees are contracted to work three consecutive quarters and then receive one full quarter off. For example, a worker might work during quarters 3 and 4 of one year and quarter 1 of the next year. During a quarter in which an employee works, he or she can produce up to 600 pairs of jeans. Each worker is paid $6,000 per quarter. At the end of each quarter, a holding cost of $10 per jean is incurred. Because the jean design changes on a yearly basis, the ending inventory at the end of quarter 4 must be sold to discount retailers. It is estimated that each unit on hand at the end of month 4 can be sold for $20. Determine how to minimize the cost per year (labor plus holding) of meeting the quarterly demand for jeans. To simplify the model, it is assumed that a given worker gets the same quarter off during each year. Also, ending inventory at the end of month 4 must incur the full holding cost for that quarter.

**Base Model:**

***Parameters:***

$D\_{i}$: Demand to produce product in quarter ‘i’

$P$: Pair of shoes produced by one employee in a quarter

$W$: Wage paid to each employee on a quarterly basis

$H$: Holding cost for each pair of shoes

$I\_{0}$: Starting inventory in quarter 1, $I\_{0}=0$

$A\_{ij}$: Information table which illustrates the employee work duration from quarter i to j

R : Unit selling price for left-over jeans at the end of month 4

***Decision Variables:***

$X\_{j}$: Number of workers available to work in quarter ‘j’

***Calculated Variables***

$N\_{j}$: $\sum\_{j=1}^{4}(X\_{j}\* A\_{ij}$) *for je{1,2,3,4}* *Number of workers available in quarter ‘j’*

$P\_{j}$ = $N\_{j}$\* P *for je{1,2,3,4}* *Number of jeans produced in quarter ‘j’*

$W\_{j}$= $N\_{j}$\* W *for je{1,2,3,4}* *Employee cost in quarter ‘j’*

$H\_{j}$= $I\_{j}$\* H *for je{1,2,3,4}* *holding cost in quarter ‘j’*

***Objective:***

$Minimize Total Cost\sum\_{j=1}^{4}(W\_{j}+H\_{j})$- $R\_{4}$ *Considers inventory sold-off at end of Q4*

***Constraints:***

$$x\_{j}\geq 0 $$

$I\_{j}$ = $I\_{j-1}$+ $P\_{j}$– $D\_{j} $*for je{1,2,3,4}* *Inventory balancing equation ensuring demand is met*