QMM PROBLEM 2

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ASSIGNMENT 1 PROBLEM 2

LP MODEL

The Weigelt Corporation has three branch plants with excess production capacity. Fortunately, the corporation has a new product ready to begin production, and all three plants have this capability, so some of the excess capacity can be used in this way. This product can be made in three sizes–large, medium, and small–that yield a net unit profit of $420, $360, and $300, respectively. Plants 1, 2, and 3 have the excess capacity to produce 750, 900, and 450 units per day of this product, respectively, regardless of the size or combination of sizes involved. The amount of available in-process storage space also imposes a limitation on the production rates of the new product. Plants 1, 2, and 3 have 13,000, 12,000, and 5,000 square feet, respectively, of in-process storage space available for a day's production of this product. Each unit of the large, medium, and small sizes produced per day requires 20, 15, and 12 square feet, respectively. Sales forecasts indicate that if available, 900, 1,200, and 750 units of the large, medium, and small sizes, respectively, would be sold per day. At each plant, some employees will need to be laid off unless most of the plant's excess production capacity can be used to produce the new product. To avoid layoffs if possible, management has decided that the plants should use the same percentage of their excess capacity to produce the new product. Management wishes to know how much of each of the sizes should be produced by each of the plants to maximize profit. a. Define the decision variables b. Formulate a linear programming model for this problem

```
table=matrix(c(420,750,13000,20,900,360,900,12000,15,1200,300,450,5000,12,750),ncol=5, byrow=T)
colnames(table)=c('PROFIT','EXCESS CAP','STORAGE','UNIT','SALES')
rownames(table)=c('large','medium','small')
table
```

```
##        PROFIT EXCESS CAP STORAGE UNIT SALES
## large     420        750   13000   20   900
## medium    360        900   12000   15  1200
## small     300        450    5000   12   750
```

PROFIT EXCESS CAP STORAGE UNIT SALES large 420 750 13000 20 900 medium 360 900 12000 15 1200 small 300 450 5000 12 750

1.Define the decision variable 2.Linear a linear programming model for this problem

Anwser:

No of large units produced at plant1: D_l1 No of medium units produced at plant1: D_m1 No of small units produced at plant1: D_s1 No of large units produced at plant1: D_l2 No of medium units produced at plant1: D_m2 No of small units produced at plant1: D_s2 No of large units produced at plant1: D_l3 No of medium units produced at plant1: D_m3 No of small units produced at plant1: D_s3

O bjective function:

$$MAX \quad Z = 420(D_l1 + D_m2 + D_s3) + 360(D_l1 + D_m2 + D_s3) + 300(D_l1 + D_m2 + D_s3)$$

Constraints

Production capacity constraints:

The production of each size at each plant should not exceed the respective plants capacity excess capacity for each plant is 750, 900 and 400 units per day.

$$D_l1 + D_m1 + D_s1 \leq 750$$

$$D_l2 + D_m2 + D_s2 \leq 900$$

$$D_l3 + D_m3 + D_s3 \leq 450$$

Storage space restrictions at present: the production of ecah size at each plant should not exceed the available in process storage space

$$20D_l1 + 15D_m1 + 12D_s1 \leq 13000$$

$$20D_l2 + 15D_m2 + 12D_s2 \leq 12000$$

$$20D_l3 + 15D_m3 + 12D_s3 \leq 5000$$

Demand constraint:

The production of each size meet the scale forecast.

$$D_l1 + D_m1 + D_s1 \leq 900$$

$$D_l2 + D_m2 + D_12 \leq 1200$$

$$D_l3 + D_m3 + D_s3 \leq 750$$

Restrictions on layoffs of employees:

$$(D_l1 + D_m1 + D_s1)/750 = (D_l2 + D_m2 + D_s2)/900 = (D_l3 + D_m3 + D_s3)/450$$

Non negativity constraints:

$$Dl > 0, Dm > 0, Ds > 0$$