IE310 ASSIGNMENT 2

marketable securites are ignored

1.)

$$Quick\ ratio = \frac{36000-2000}{9500+7500} = 2\ which\ is \geq 2.0$$

2.)

$\boldsymbol{Const1}$: $y1 + y2 \leq 800 \rightarrow$ Limitation for sales

$\boldsymbol{Const2}$: $10x1 + 16y1 \leq 6400 \rightarrow$ 1st Week Production

$\boldsymbol{Const3}$: $10x2 + 16y2 \leq 8000 \rightarrow$ 2nd Week Production

End. bal. (W1) $=$ Cash $+$ Acc. Rec. $-$ Acc. Pay. $-$ Salary $-$ Labor $\geq$ min bal.

$= 2,000 + 32,000 - 9,500 - 200 - (30x1 + 48y1) \geq 500$

$\boldsymbol{Const4}$: $30x1 + 48y1 \leq 23{,}800 \rightarrow$ 1st Week Cash Balance

End. bal. (W2) $=$ Cash $+$ Acc. Rec. $-$Acc. Pay. $-$ Salary $-$ Labor $-$ Raw Mat. $\geq$ min bal.

$= (24300 - 30x1 - 48y1) + 55x1 + 125y1 - (30x2 + 48y2) - 200 - (10x1 + 50y1) \geq 500$

$\boldsymbol{Const5}$: $-15x1 - 27y1 + 30x2 + 48y2 \leq 23600. \rightarrow$ 2nd Week Cash Balance

Ratio (W1) $= \frac{24300 - 30x1 - 48y1 + 55x1 + 125y1}{10x1 + 50y1 + 7500} \geq 2.0$

$\boldsymbol{Const6}$: $-5x1 + 23y1 \leq 9300 \rightarrow$ 1st Week Quick ratio

Ratio (W2) $= \frac{24100 + 15x1 + 27y1 - 30x2 - 48y2 + 55x2 + 125y2}{10x2 + 50y2 + 7500} \geq 2.0$

$\boldsymbol{Const7}$: $-15x1 - 27y1 - 5x2 + 23y2 \leq 9100 \rightarrow$ 2nd Week Quick Ratio

3.)

GAMS Output:

```
LP Presolve eliminated 4 rows and 1 columns.
Aggregator did 1 substitutions.
Reduced LP has 3 rows, 3 columns, and 7 nonzeros.
Presolve time = 0.00 sec. (0.01 ticks)

Iteration      Dual Objective            In Variable           Out Variable
     1 sI           0.000000                     y2           const5 slack
     2       29200.000000                     x2           const1 slack
     3       24000.000000          const5 slack            const3 slack
LP status(1): optimal
Cplex Time: 0.00sec (det. 0.01 ticks)

Optimal solution found.
Objective :       24000.000000
```

```
                          LOWER          LEVEL          UPPER         MARGINAL

---- VAR x1                 .              .             +INF            EPS
---- VAR y1                 .            400.0000        +INF            .
---- VAR x2                 .            160.0000        +INF            .
---- VAR y2                 .            400.0000        +INF            .
---- VAR z                -INF         24000.0000        +INF            .

  z  total max profit
```

Optimal profit is 24000 – Manager Salary = **23600$.**

4.) To smooth ABCO's production over the two-week period for X and Y we want $|x1 - x2| \leq 0.\alpha(x1 + x2)$ *and* $|y1 - y2| \leq 0.\alpha(y1 + y2)$ where α is the percentage fluctuation that management is willing to permit.

$-0.\alpha(x1 + x2) \leq x1 - x2 \leq 0.\alpha(x1 + x2)$ and $-0.\alpha(y1 + y2) \leq y1 - y2 \leq 0.\alpha(y1 + y2)$

We need to add the following constraints to the LP at the second question. ($\alpha = \%20$ at this case)

$\boldsymbol{Const8}$: $-1.2x1 + 0.8x2 \leq 0 \rightarrow$ Smoothing x

$\boldsymbol{Const9}$: $-1.2x2 + 0.8x1 \leq 0 \rightarrow$ Smoothing x

$\boldsymbol{Const10}$: $-1.2y1 + 0.8y2 \leq 0 \rightarrow$ Smoothing y

$\boldsymbol{Const11}$: $-1.2y2 + 0.8y1 \leq 0 \rightarrow$ Smoothing y

According to my GAMS Model, the new constraints did not affect the optimal profit and it is still **23600$.**

The cost:

```
LP Presolve eliminated 3 rows and 1 columns.
Reduced LP has 9 rows, 4 columns, and 22 nonzeros.
Presolve time = 0.00 sec. (0.01 ticks)

Iteration      Dual Objective            In Variable           Out Variable
     1 sI           30.000000                     y1           const1 slack
     2 sI           15.000000                     x2           const3 slack
     3 sI            0.000000                     y2           const2 slack
     4          24000.000000                     x1           const8 slack
LP status(1): optimal
Cplex Time: 0.00sec (det. 0.02 ticks)

Optimal solution found.
Objective :       24000.000000
```

```
                          LOWER          LEVEL          UPPER         MARGINAL

---- VAR x1                 .            64.0000        +INF             .
---- VAR y1                 .           360.0000        +INF             .
---- VAR x2                 .            96.0000        +INF             .
---- VAR y2                 .           440.0000        +INF             .
---- VAR z                -INF        24000.0000        +INF             .

  z  total max profit
```

If $\alpha = \%10$ *instead of* $\%20$;

```
LP Presolve eliminated 3 rows and 1 columns.
Reduced LP has 9 rows, 4 columns, and 22 nonzeros.
Presolve time = 0.00 sec. (0.01 ticks)

Iteration      Dual Objective            In Variable           Out Variable
     1 sI           30.000000                     y1           const1 slack
     2 sI           15.000000                     x2           const3 slack
     3 sI            0.000000                     x1           const9 slack
     4          29066.666667                     y2          const11 slack
     5          24000.000000          const11 slack           const2 slack
     6          24000.000000           const9 slack          const10 slack
     7          23733.333333           const3 slack           const8 slack
LP status(1): optimal
Cplex Time: 0.00sec (det. 0.02 ticks)

Optimal solution found.
Objective :       23733.333333
```

```
                          LOWER          LEVEL          UPPER         MARGINAL

---- VAR x1                 .            64.0000        +INF             .
---- VAR y1                 .           360.0000        +INF             .
---- VAR x2                 .            78.2222        +INF             .
---- VAR y2                 .           440.0000        +INF             .
---- VAR z                -INF        23733.3333        +INF             .

  z  total max profit
```

We need to add the following constraints to the LP at the second question. ($\alpha = \%10$ at this case)

$\boldsymbol{Const8}$: $-1.1x1 + 0.9x2 \leq 0$

$\boldsymbol{Const9}$: $-1.1x2 + 0.9x1 \leq 0$

$\boldsymbol{Const10}$: $-1.1y1 + 0.9y2 \leq 0$

$\boldsymbol{Const11}$: $-1.1y2 + 0.9y1 \leq 0$

The profit would be 23333.3333$.

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