Chapter 3/#29

a. Let   XO1 = percentage of Oak cabinets assigned to cabinetmaker 1
           XO2 = percentage of Oak cabinets assigned to cabinetmaker 2
           XO3 = percentage of Oak cabinets assigned to cabinetmaker 3
           XC1 = percentage of Cherry cabinets assigned to cabinetmaker 1
           XC2 = percentage of Cherry cabinets assigned to cabinetmaker 2
           XC3 = percentage of Cherry cabinets assigned to cabinetmaker 3

```
MINIMIZE 1800XO1+1764XO2+1650XO3+2160XC1+2016XC2+1925XC3

   S.T. XO1, XO2, XO3, XC1, XC@, XC3 > 0 AND

     1)   1XO1 + 1XO2 + 1XO3                = 1
     2)                 1XC1 + 1XC2 + 1XC3  = 1
     3)  50XO1          +60XC1              < 40
     4)        42XO2          +48XC2        < 30
     5)                 30XO3         +35XC3 < 35
```

OPTIMAL SOLUTION: Objective Function Value =$3672.500

```
     Variable              Value              Reduced Costs
   --------------       ---------------      ------------------
      XO1                    0.271                  0.000
      XO2                    0.000                 37.500
      XO3                    0.729                  0.000
      XC1                    0.000                 60.000
      XC2                    0.625                  0.000
      XC3                    0.375                  0.000

    Constraint          Slack/Surplus           Dual Prices
   --------------       ---------------      ------------------
       1                    0.000                -1800.000
       2                    0.000                -2100.000
       3                   26.458                   0.000
       4                    0.000                   1.750
       5                    0.000                   5.000
```
OBJECTIVE COEFFICIENT RANGES

```
    Variable     Lower Limit      Current Value     Upper Limit
   ------------  ---------------  ---------------  ---------------
      XO1           1728.000         1800.000         1851.429
      XO2           1726.500         1764.000       No Upper Limit
      XO3           1598.571         1650.000         1686.735
      XC1           2100.000         2160.000       No Upper Limit
      XC2         No Lower Limit      2016.000         2058.857
      XC3           1882.143         1925.000         1985.000
```

RIGHT HAND SIDE RANGES

```
    Constraint    Lower Limit      Current Value     Upper Limit
   ------------  ---------------  ---------------  ---------------
       1             0.729            1.000            1.529
       2             0.768            1.000            1.454
       3            13.542           40.000        No Upper Limit
       4             8.229           30.000           41.143
       5            19.125           35.000           43.125
```

b.

	Cabinetmaker 1	Cabinetmaker 2	Cabinetmaker 3
Oak	$O1 = 0.271$	$O2 = 0.000$	$O3 = 0.729$
Cherry	$C1 = 0.000$	$C2 = 0.625$	$C3 = 0.375$

Total Cost = $3672.50

c. Since cabinetmaker 1 has a slack of 26.458 hours, having additional hours available will not change the optimal solution. Alternatively, since the dual price for constraint 1 is 0, increasing the right hand side of constraint 1 will not change the value of the optimal solution.

d. The dual price for constraint 2 is 1.750. The upper limit on the range of feasibility is 41.143. Therefore, each additional hour of time for cabinetmaker 2 will reduce total cost by $1.75 per hour, up to a maximum of 41.143 hours. So, if cabinetmaker 2 has additional hours available, the optimal solution will change.

e. If cabinetmaker 2 reduced its cost to $38 per hour, the new objective function coefficients for $XO2$ and $XC2$ are 42(38) = 1596 and 48(38) = 1824, respectively. The optimal solution does not change but the total cost decreases to $3552.50.