Solutions to Homework #2

1.

(a) $P_1 + P_2 + P_3 \leq 2$

(b) $P_1 - P_2 - P_3 \leq 0$

(c) $-P_1 + 2P_2 + P_3 \geq 1$

2.

Let P = the number of police cruisers to purchase
A = the number of ambulances to purchase
F = the number of fire trucks to purchase

Max F

s.t.

$$\begin{aligned}
15000P + 25000A + 48000F &\leq 700000 && \text{(budget)}\\
2A - F &\geq 0 && \text{(fire-truck ratio)}\\
15000P - 96000F &\geq 0 && \text{(police-cruiser expenditure)}\\
F &\geq 3\\
F &\leq 6\\
P, A, F &\geq 0 \text{ and integer}
\end{aligned}$$

3. In this problem, you have to decide whether to include arc ij or not, which leads to the following decision variables:

$x_{ij} = 1$ if arc ij is included in the collection, and 0 otherwise.

The desired integer program is:

$$\max \quad \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}x_{ij}$$

s.t.

$$\sum_{j=1}^{n} x_{ij} \leq 3 \text{ for all } i \neq j \quad \text{(at most 3 arcs can use node } i\text{)}$$

$$x_{ij} = 0 \text{ for all } ij \text{ that are not arcs and all } x_{ij} = 0 \text{ or } 1$$

4.

(a) The optimal solution from Solver for the problem of BlubberMaid is:

Target Cell (Max)

Cell	Name	Original Value	Final Value
F12	Airtex Profit	39	13133.33333

Adjustable Cells

Cell	Name	Original Value	Final Value
C12	Airtex Pounds	1	1000
C13	Extendex Pounds	2	533.3333333
C14	Resistex Pounds	3	400

(b) The optimal solution from Solver for the Make-or-Buy problem is:

Target Cell (Max)

Cell	Name	Original Value	Final Value
J14	CJ Profit	96	55000

Adjustable Cells

Cell	Name	Original Value	Final Value
C15	AP	1	2000
D15	BP	2	0
E15	CP	3	2333.333333
F15	AJ	4	0
G15	BJ	5	4000
H15	CJ	6	2666.666667

(c) The Energy Problem is infeasible.

5. The results from using OpenSolver to solve the problem of Capital Bank lead to:
   (a) The optimal solution $x_1 = 0$, $x_2 = 1$, $x_3 = 1$, $x_4 = 1$, which means you should invest in Projects 2, 3, and 4.
   (b) With these investments, the return is expected to be $42 million.
   (c) The budget constraint is binding because the optimal plan is to invest all $14 million (and so the slack variable has value 0).

6. The value you get for the total transportation cost varies with each birth date that is used. However, regardless of the birth date used, when you attempt to solve this problem using Solver, you get the following error message: To Many Variable Cells.