3/25 HW

4. $C_5^2 = C_2^7 = \frac{7\times6}{2} = 21$ 21 ways

X_{ij} = i, j the day-offs

min $X_{13}+X_{14}+X_{15}+X_{16}+X_{24}+X_{25}+X_{26}+X_{27}+X_{35}+X_{36}+X_{37}$
$+X_{46}+X_{47}+X_{57}$

s.t

$20-(X_{16}+X_{26}+X_{36}+X_{46}) \geq 25$
$20-(X_{27}+X_{37}+X_{47}+X_{57}) \geq 16$
$30-(X_{13}+X_{14}+X_{15}+X_{16}) \geq 12$
$30-(X_{24}+X_{25}+X_{26}+X_{27}) \geq 20$
$30-(X_{35}+X_{36}+X_{37}+X_{13}) \geq 18$
$20-(X_{14}+X_{24}+X_{46}+X_{47}) \geq 22$
$20-(X_{15}+X_{25}+X_{35}+X_{57}) \geq 25$
$X_{i,j} \geq 0 \quad \forall i=1..7 \quad j=i+1..7$

8. Fire station is located at (x, y)

min $\frac{1}{160}[20(|x-20|+|y-20|)+30(|x-60|+|y-10|)$
$+50(|x-40|+|y-30|)+20(|x-40|+|y-60|)$
$+15(|x-30|+|y-0|)+25(|x-10|+|y-70|)]$

s.t $x, y \geq 0$

$\rightarrow \frac{1}{16}(2|x-20|+2|y-20|+3|x-60|+3|y-10|+7|x-40|+5|y-30|$
$+21y-60| + 1.5|x-30| + 1.5|y| + 2.5|x-10| + 2.5|y-70|)$
(a, b, c, d, e, f; g, h, i, j, k)

min $\frac{1}{8}a+\frac{1}{8}b+\frac{3}{16}c+\frac{3}{16}d+\frac{7}{16}e+\frac{5}{16}f+\frac{1}{8}g+\frac{1.5}{16}h+\frac{1.5}{16}i$
$+\frac{2.5}{16}j+\frac{2.5}{16}k$

s.t

$a \geq x-20$	$d \geq y-10$	$g \geq y-60$	$j \geq x-10$
$a \geq 20-x$	$d \geq 10-y$	$g \geq 60-y$	$j \geq 10-x$
$b \geq y-20$	$e \geq x-40$	$h \geq x-30$	$k \geq y-70$
$b \geq 20-y$	$e \geq 40-x$	$h \geq 30-x$	$k \geq 70-y$
$c \geq x-60$	$f \geq y-30$	$i \geq y$	
$c \geq 60-x$	$f \geq 30-y$	$i \geq -y$	

11.

```
ampl: reset;
ampl: model eg2.mod;
ampl: data data.dat;
ampl: solve;
CPLEX 12.9.0.0: optimal solution; objective 10733.33333
1 dual simplex iterations (0 in phase I)
ampl: display x;
x [*] :=
1  566.667
2  100
3    0
4  333.333
;
```

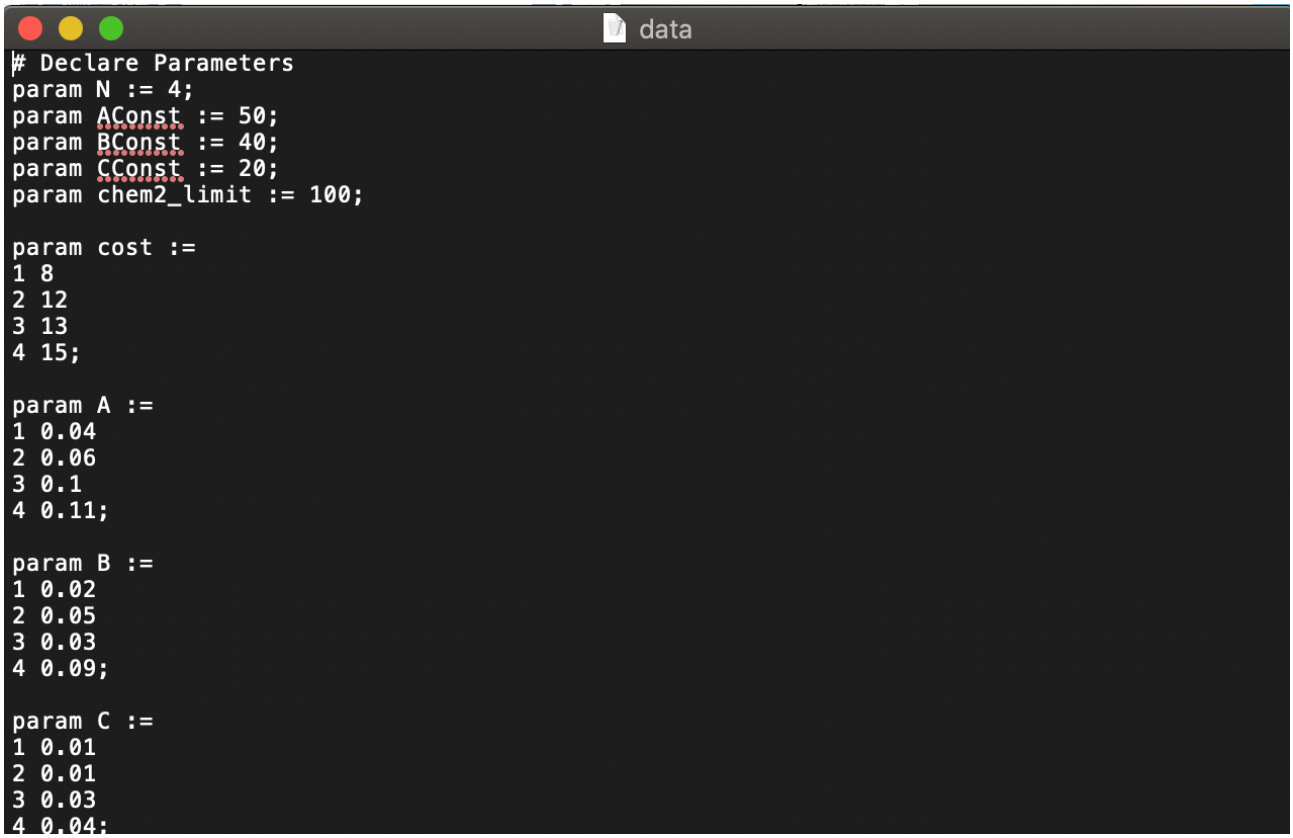
chemical 1 = 566.667 (lb)
chemical 2 = 100 (lb)
chemical 3 = 0
chemical 4 = 333.333 (lb)

the total cost is 10733.33333

model

```
# define parameters
param N;
param AConst;
param BConst;
param CConst;
param chem2_limit;

param cost{i in 1..N};
param A{i in 1..N};
param B{i in 1..N};
param C{i in 1..N};

# define var.
var x{i in 1..N} >=0;

# define objective func.
minimize Cost : sum{i in 1..N}(cost[i] * x[i]);

#define constraint
subject to constraint_1 : sum{i in 1..N}(x[i]) = 1000;
subject to constraint_2 : sum{i in 1..N}(x[i] * A[i]) >= AConst;
subject to constraint_3 : sum{i in 1..N}(x[i] * B[i]) >= BConst;
subject to constraint_4 : sum{i in 1..N}(x[i] * C[i]) >= CConst;
subject to constraint_5 : x[2] >= chem2_limit;
```

data


data
# Declare Parameters
param N := 4;
param AConst := 50;
param BConst := 40;
param CConst := 20;
param chem2_limit := 100;
param cost :=
1 8
2 12
3 13
4 15;
param A :=
1 0.04
2 0.06
3 0.1
4 0.11;
param B :=
1 0.02
2 0.05
3 0.03
4 0.09;
param C :=
1 0.01
2 0.01
3 0.03
4 0.04;