Problema 2

Alessandro Pontini

4/29/2020

Mappa concettuale del problema

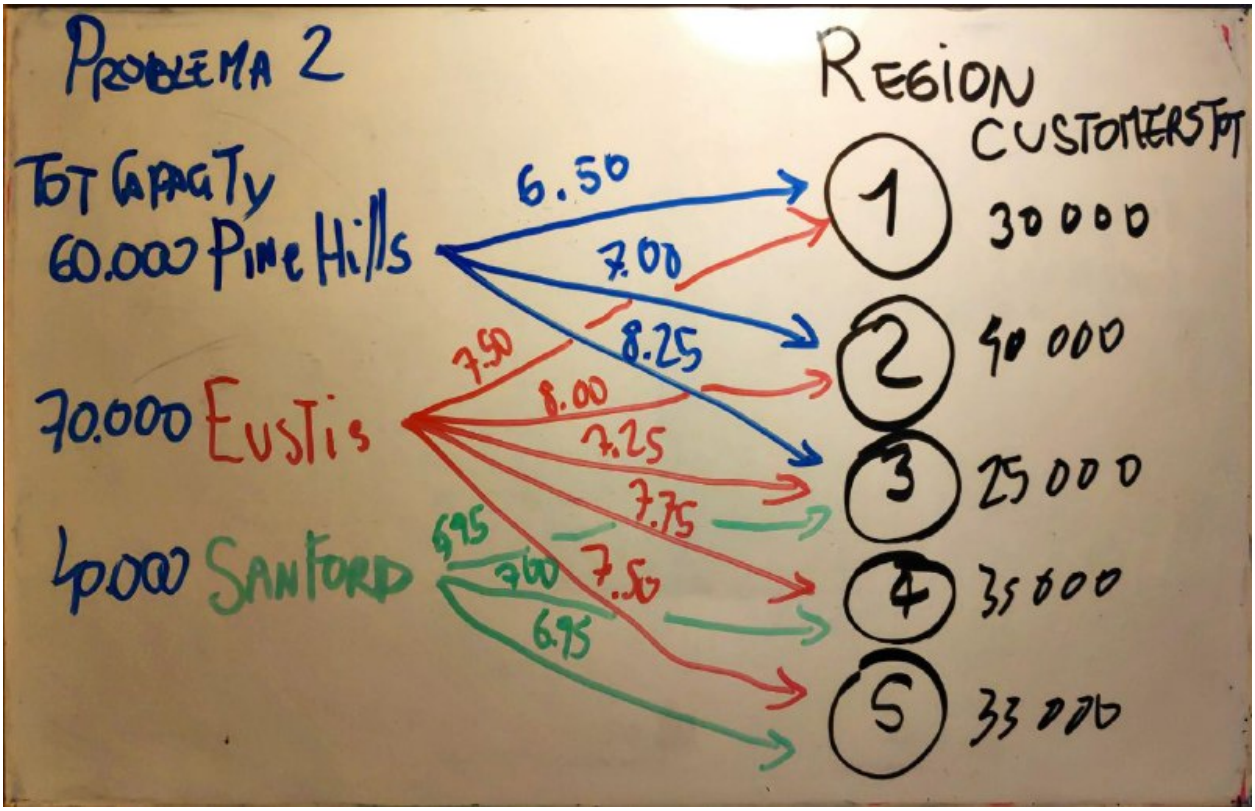

Figure 1: mappa Concettuale lavoro

Vogliamo trovare quanti clienti possiamo servire minimizzando i costi relativi.

Modello Risoluzione

Sostanzialmente l'equazioni che andiamo a creare sono:

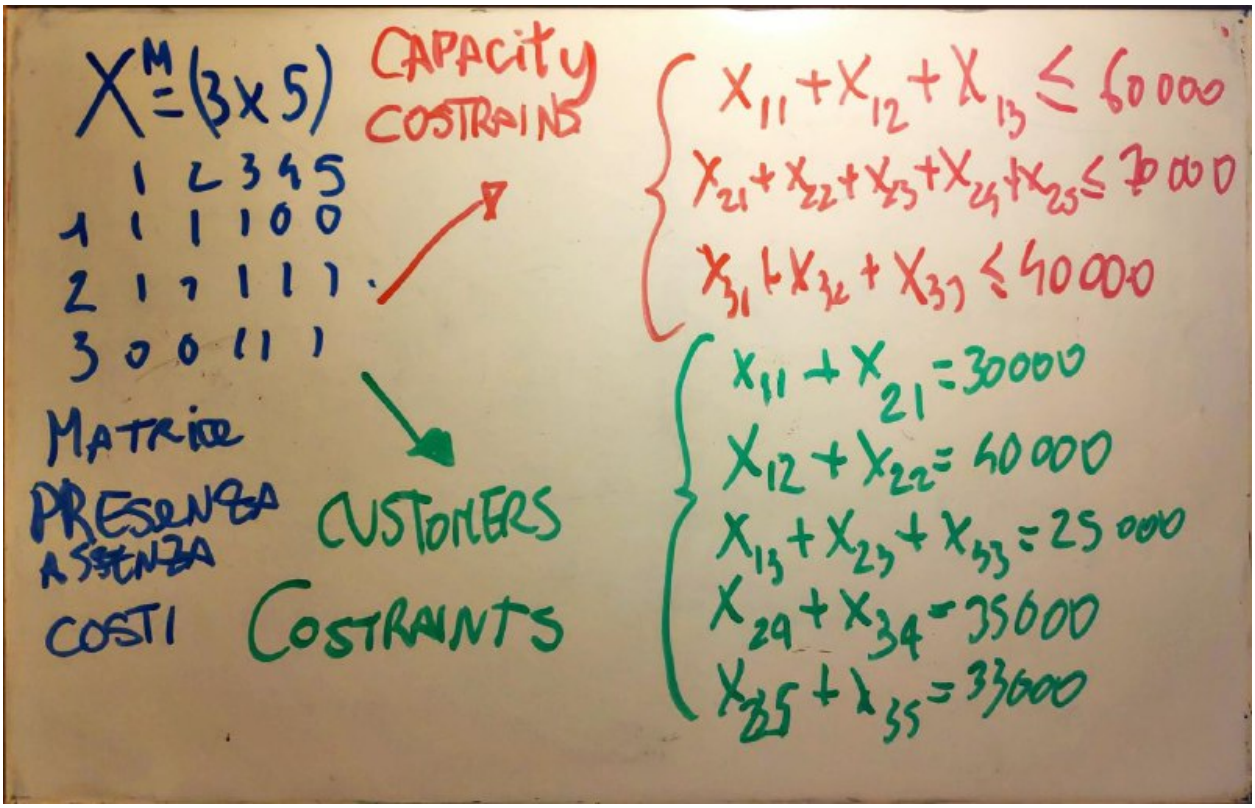

Figure 2: Idea di lavoro alla base

$$\min \quad 6.5x_{11} + 7.0x_{12} + 8.25x_{13} + 7.5x_{21} + 8.0x_{22} + 7.25x_{23} + 7.75x_{24} + 7.5x_{25} + 6.75x_{31} + 7.0x_{32} + 6.75x_{33}$$

$$x_{11} + x_{12} + x_{13} \leq 60000,$$
$$x_{21} + x_{22} + x_{23} + x_{24} + x_{25} \leq 70000,$$
$$x_{31} + x_{32} + x_{33} \leq 40000,$$
$$x_{11} + x_{21} = 30000$$
$$x_{12} + x_{22} = 40000$$
$$x_{13} + x_{23} + x_{33} = 25000$$
$$x_{24} + x_{34} = 35000$$
$$x_{25} + x_{35} = 33000$$
$$x_{11}, x_{12}, x_{13}x_{21}, x_{22}, x_{23}, x_{24}, x_{25}, x_{31}, x_{32}, x_{33} \in \{0, Inf\}$$

```
library(lpSolveAPI)

x = data.frame(index_i=c(1,1,1, 2,2,2,2,2 ,3,3,3),
               index_j =c(1,2,3, 1,2,3,4,5, 3,4,5),
               lb      =c(0,0,0,  0,0,0,0,0, 0,0,0),
               ub      =c(Inf,Inf,Inf,Inf,Inf,Inf,Inf,Inf,Inf,Inf,Inf),
               cost    =c(6.5,7,8.25,  7.5,8,7.25,7.75,7.50,  6.75,7,6.75))
b =c(60000,70000,40000,  30000,40000,25000,35000,33000)
```

```
model = make.lp(0,11)
lp.control(model, sense="min")
set.objfn(model,obj=x$cost)


#x11 + x12 + x13 = 60000
add.constraint(model,
               xt=c(1,1,1),
               type="<=",
               rhs=b[1],
               indices=c(1:3))

#x21 + x22 + x23 + x24 + x25  = 70000
add.constraint(model,
               xt=c(1,1,1,1,1),
               type="<=",
               rhs=b[2],
               indices=c(4:8))

# x33 + x34 + x35 = 40000
add.constraint(model,
               xt=c(1,1,1),
               type="<=",
               rhs=b[3],
               indices=c(9:11))

# x11 + x21 = 30000
add.constraint(model,
               xt=c(1,1),
               type="=",
               rhs=b[4],
               indices=c(1,4))

# x12 + x22 = 40000
add.constraint(model,
               xt=c(1,1),
               type="=",
               rhs=b[5],
               indices=c(2,5))

# x13 + x23 + x33 = 25000
add.constraint(model,
               xt=c(1,1,1),
               type="=",
               rhs=b[6],
               indices=c(3, 6, 9))

#  x24 + x34 = 35000
add.constraint(model,
               xt=c(1,1),
               type="=",
               rhs=b[7],
               indices=c(7, 10))
```

```
#  x25 + x35 = 33000
add.constraint(model,
               xt=c(1,1),
               type="=",
               rhs=b[8],
               indices=c(8,11))

set.bounds(model,lower=x$lb,upper=x$ub)

solve(model)
```

```
v <-get.variables(model)
x <- cbind(x,y_val = v)
x[c("index_i", "index_j", "y_val")]
```

```
##    index_i index_j y_val
## 1        1       1 20000
## 2        1       2 40000
## 3        1       3     0
## 4        2       1 10000
## 5        2       2     0
## 6        2       3 25000
## 7        2       4     0
## 8        2       5 28000
## 9        3       3     0
## 10       3       4 35000
## 11       3       5  5000
```

```
get.objective(model)
```

```
## [1] 1155000
```

Trovo che la ottima soluzione che minimizza i costi è di 1.155.000$ e possiamo vedere come evolvono rapporti rispetto all'inizio con questo grafico.

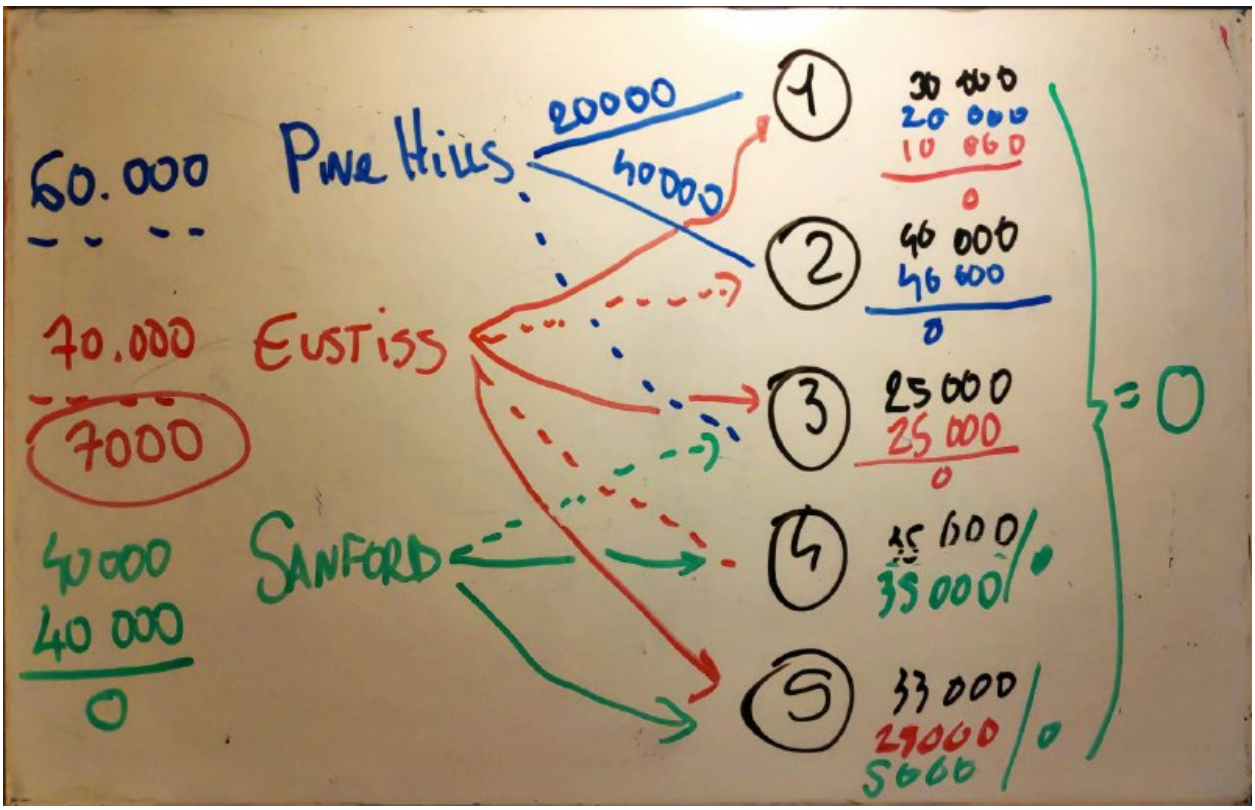

Figure 3: mappa Concettuale lavoro finale