MATLAB Computations

>> A = [3 2 1 4 1 0; 4 3 3 3 0 -1; 1 1 1 1 0 0]

A =  
3     2     1     4     1     0
7     3     3     3     0    -1
1     1     1     1     0     0

>> B = A(:,[1 2 6])

B =  
3     2     0
4     3    -1
1     1     0

>> N = A(:,[3 4 5])

N =  
1     4     1
3     3     0
1     1     0

>> b = [7 8 3]'

b =  
7
8
3
>> Binv = inv(B)

\[
\begin{pmatrix}
1 & 0 & -2 \\
-1 & 0 & 3 \\
1 & -1 & 1
\end{pmatrix}
\]

>> Binv*b

\[
\begin{pmatrix}
1 \\
2 \\
2
\end{pmatrix}
\]

>> -Binv*N

\[
\begin{pmatrix}
1 & -2 & -1 \\
-2 & 1 & 1 \\
1 & -2 & -1
\end{pmatrix}
\]

Recall: \( x_B = B^{-1}b - B^{-1}N x_N \)
>> \texttt{c} = [28 \ 30 \ 20 \ 25 \ 0 \ 0] \\

c = \begin{array}{cccccc}
28 & 30 & 20 & 25 & 0 & 0
\end{array}

>> \texttt{cB} = \texttt{c([1 2 6])} \\

cB = \begin{array}{cccc}
28 & 30 & 0
\end{array}

>> \texttt{cN} = \texttt{c([3 4 5])} \\

cN = \begin{array}{cccc}
20 & 25 & 0
\end{array}

>> \texttt{rc} = \texttt{cN - cB*Binv*N} \\

cr = \begin{array}{cccc}
-12 & -1 & 2
\end{array}

These are the reduced costs of the nonbasic variables \(x_3, x_4, x_5\).

The current basis \{1, 2, 6\} is not optimal.
Try the basis defined by columns/variables \{3, 5, 6\}:

```
>> B = A(:,[3 5 6])

   1   1   0
B = 3   0  -1
   1   0   0

>> N = A(:,[1 2 4])

  3   2   4
N = 4   3   3
   1   1   1

>> Binv = inv(B)

   0   0   1
Binv = 1   0  -1
   0  -1   3

>> Binv*b

   3
ans = 4
   1
```
Since all reduced costs are nonnegative, the basis \{3, 5, 6\} is optimal.
Let’s look at the direction defined by increasing the nonbasic variable $x_4$.

\[
\begin{array}{ccccccc}
3 & 2 & 1 & 4 & 1 & 0 \\
A &=& 4 & 3 & 3 & 3 & 0 & -1 \\
& & 1 & 1 & 1 & 1 & 0 & 0 \\
\end{array}
\]

\[
c = 28 & 30 & 20 & 25 & 0 & 0 \\
\]

\[
\begin{array}{c}
 >> d = [-2 \ 1 \ 0 \ 1 \ 0 \ -2]'
\end{array}
\]

\[
d = \begin{array}{c}
-2 \\
1 \\
0 \\
1 \\
0 \\
-2 \\
0
\end{array}
\]

\[
A*d = 0 \\
c*d = -1
\]

In general we have $Ad = 0$ and $c^Td < 0$. 