Problem-10

$$\begin{aligned} k_2(x_2 - x_1) &= kx_1 \\ k_3(x_3 - x_2) &= k_2(x_2 - x_1) \\ k_4(x_4 - x_3) &= k_3(x_3 - x_2) \\ F = 2000 &= k_4(x_4 - x_3) \end{aligned} \qquad \text{(Given)}$$

k_1, k_2, k_3, k_4 are $100, 50, 80, 200$ respectively.

$$\begin{bmatrix} -(k_2 + k_1) & k_2 & 0 & 0 \\ k_2 & -(k_3 + k_2) & k_3 & 0 \\ 0 & k_3 & -(k_4 + k_3) & k_4 \\ 0 & 0 & -k_4 & k_4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 2000 \end{bmatrix}$$

The above is a banded matrix, thus we will use Thomas Algorithm.

The Output

```
>> T10_20110065

ans =

  19.999999999999996
  59.999999999999993
  85.000000000000000
  95.000000000000000
```

The output is basically 20,60,85 and 95.

(*a*) Decomposition

```
DOFOR k = 2, n
  e_k = e_k / f_k-1
  f_k = f_k - e_k · g_k-1
END DO
```

(*b*) Forward substitution

```
DOFOR k = 2, n
  r_k = r_k - e_k · r_k-1
END DO
```

(c) Back substitution

```
x_n = r_n / f_n
DOFOR k = n -1, 1, -1
  x_k = (r_k - g_k · x_k+1)/f_k
END DO
```

Pseudocode from the book.