Class 1 (10.01.2017)

1. Write a C code for the following algorithm.
2. Use this algo as a function and solve m simultaneous equations with n unknowns ($m<n$) to obtain basic solutions.
3. Check your program for the following examples and count the number of basic solutions:
   (a) $x_1 + x_2 + S_1 = 40, 2x_1 + x_2 + S_2 = 60$
   (b) $2x_1 + x_2 + S_1 = 100, x_1 + x_2 + S_2 = 80, x_1 + S_3 = 40$

Gauss-Seidel Method Algorithm:

1. Start
2. Declare the variables and read the order of the matrix n
3. Read the stopping criteria er
4. Read the coefficients aim as
   Do for i=1 to n
   Do for j=1 to n
   Read a[i][j]
   Repeat for j
   Repeat for i
5. Read the coefficients b[i] for i=1 to n
6. Initialize x0[i] = 0 for i=1 to n
7. Set key=0

8. For i=1 to n

    Set sum = b[i]

    For j=1 to n

    If (j not equal to i)

    Set sum = sum – a[i][j] * x0[j]

    Repeat j

    x[i] = sum/a[i][i]

    If absolute value of ((x[i] – x0[i]) / x[i]) > er, then

    Set key = 1

    Set x0[i] = x[i]

    Repeat i
9. If key = 1, then

    Goto step 6

    Otherwise print results

```
                    ┌─────────────┐
                    │    Start    │
                    └──────┬──────┘
                           │
                    ┌──────▼──────┐
                    │   Input n   │
                    └──────┬──────┘
                           │
                  ╱────────▼────────╲
                 ╱   For i = 1, n    ╲
                 ╲  For j = 1, n + 1 ╱
                  ╲────────┬────────╱
                           │
                    ┌──────▼──────┐
                    │  Input a(i,j)│
                    └─────────────┘

                  ╱─────────────────╲
                 ╱   For i = 1, n    ╲
                  ╲─────────┬───────╱
                           │
                    ┌──────▼──────┐
                    │   x(i) = 0  │
                    │   y(i) = 0  │
                    └─────────────┘

                    ┌─────────────┐
                    │   itr = 0   │
                    └──────┬──────┘
                           │
                    ┌──────▼──────┐
                    │ itr = itr + 1│
                    └──────┬──────┘
                           │
                  ╱────────▼────────╲
                 ╱   For i = 1, n    ╲
                  ╲─────────┬───────╱
                           │
                    ┌──────▼──────┐
                    │x(i) = a(i, n + 1)│
                    └──────┬──────┘
                           │
                  ╱────────▼────────╲
                 ╱   For j = 1, n    ╲
                  ╲─────────┬───────╱
                           │
                       ╱───▼───╲
                      ╱   If    ╲      Yes
                      ╲  i = j  ╱─────────────┐
                       ╲───┬───╱              │
                           │ No               │
                    ┌──────▼──────────────┐   │
                    │x(i) = x(i) − a(i, j)*x(j)│◄─┘
                    └─────────────────────┘

                    ┌─────────────┐
                    │x(i) = x(i)/a(i, i)│
                    └──────┬──────┘
                           │
                       ╱───▼───╲
                      │    A    │
                       ╲───────╱

                                          ╱───╲
                                         │  b  │
                                          ╲───╱
```

```
        (A)                                    (b)

   ┌─────────────────────────────────┐
   │      ⬡ For k = 1, n ⬡           │
   │              │                   │
   │              ▼                   │
   │         ╱         ╲              │
   │        ╱    If      ╲     No      │
   │       ⟨ abs (x(k) − y(k)) > 0.0001 ⟩────────┐
   │        ╲           ╱             │          │
   │         ╲         ╱              │          │
   │              │ Yes               │          │
   │              ▼                   │          │
   │        ╱ Print itr ╱            │          │
   │              │                   │          │
   │              ▼                   │          │
   │   ┌──────────────────────────┐  │          │
   │   │   ⬡ For i = 1, n ⬡      │  │          │
   │   │          │               │  │          │
   │   │          ▼               │  │          │
   │   │   ┌──────────────┐       │  │          │
   │   │   │  y(i) = x(i) │       │  │          │
   │   │   └──────────────┘       │  │          │
   │   │          │               │  │          │
   │   │          ▼               │  │          │
   │   │   ╱ Print x(i) ╱        │  │          │
   │   └──────────────────────────┘  │          │
   │              │                   │          │
   └──────────────┼───────────────────┘          │
                  ▼                               
            (  Stop  )
```

For k = 1, n

If abs (x(k) − y(k)) > 0.0001   No

Yes

Print itr

For i = 1, n

y(i) = x(i)

Print x(i)

Stop