ICE for Week 3

Problem 1

- a=[1 2 3; 4 5 6]
- x=0:30:180;
- Table=[x' sin(x*pi/180)']

Problem 2

- Evaluate the following MATLAB expressions before checking the answers in MATLAB

```
1 + 2 * 3
4 / 2 * 2
1 + 2 / 4
1 + 2 \ 4
2 * 2 ^ 3
2 * 3 \ 3
2 ^ (1 + 2)/3
1/2e-1
```

Use MATLAB to evaluate the following expressions.

$\frac{1}{2\times3}$

$2^{2\times3}$

$1.5 \times 10^{-4} + 2.5 \times 10^{-2}$

Problem 3

Write MATLAB programs to find the following sums with `for` loops and by vectorization. Time both versions in each case.

- $1^2 + 2^2 + 3^2 + \cdots + 1000^2$ (sum is 333,833,500).
- $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \cdots - \frac{1}{1003}$ (sum is 0.7849—converges slowly to $\pi/4$).
- Sum the left-hand side of the series:

$$\frac{1}{1^2 \cdot 3^2} + \frac{1}{3^2 \cdot 5^2} + \frac{1}{5^2 \cdot 7^2} + \cdots = \frac{\pi^2 - 8}{16}$$ (sum is 0.1169 – with 500 terms).

Problem 4

The following statements all assign logical expressions to the variable x. See if you can correctly determine the value of x in each case before checking your answer with MATLAB.

(a) `x = 3 > 2`

(b) `x = 2 > 3`

(c) `x = -4 <= -3`

(d) `x = 1 < 1`

(e) `x = 2~= 2`

(f) `x = 3 == 3`

(g) `x = 0 < 0.5 < 1`

Problem 5

Write a single statement to find and display the sum of the successive *even* integers 2, 4, …, 200. (Answer: 10,100)

Ten students in a class take a test. The marks are out of 10. All the marks are entered in a MATLAB vector, `marks`:

```
5    8    0    10    3    8    5    7    9    4    (Answer: 5.9)
```

Write a statement to find and display the average mark. Try it on the following:

Problem 6

What are the values of x and a after the following statements have been executed?

```
(a)  a = 0;
(b)  i = 1;
(c)  x = 0;
(d)  a = a + i;
(e)  x = x + i / a;
(f)  a = a + i;
(g)  x = x + i / a;
(h)  a = a + i;
(i)  x = x + i / a;
(j)  a = a + i;
(k)  x = x + i / a;
```

- Rewrite the statements in more economically by using a for loop. Can you do even better by vectoring the code?

Problem 7

Work out by hand the output of the following script for n = 4:

```
n = input( 'Number of terms? ' );
    s = 0;
for k = 1:n
   s = s + 1 / (k ^ 2);
end;
disp(sqrt(6 * s))
```

If you run this script for larger and larger values of n, you will find that the output approaches a well-known limit. Can you figure out what it is? Now rewrite the script using vectors and array operations.

Problem 8

Work through the following script by hand. Draw up a table of the values of `i`, `j`, and `m` to show how they change while the script executes. Check your answers by running the script:

```
v = [3 1 5];
  i = 1;

      for j = v
           i = i + 1;
           if i == 3
              i = i + 2;
              m = i + j;
           end
      end
```

Problem 9

The steady-state current I flowing in a circuit that contains a resistance $R=5$, capacitance $C=10$, and inductance $L=4$ in series is given by:

$$I = \frac{E}{\sqrt{R^2 + (2\pi\omega L - \frac{1}{2\pi\omega C})^2}},$$

where $E=2$ and $\omega=2$ are the input voltage and angular frequency, respectively. Compute the value of I. (Answer: 0.0396)

Problem 10

If you invest $1000 for one year at an interest rate of 12%, the return is $1120 at the end of the year. But if interest is compounded at the rate of 1% *monthly* (i.e., 1/12 of the annual rate), you get slightly more interest because it is compounded. Write a program that uses a `for` loop to compute the balance after a year of compounding interest in this way. The answer should be $1126.83. Evaluate the formula for this result separately as a check: 1000×1.01^{12}.

Problem 11

A plumber opens a savings account with $100,000 at the beginning of January. He then makes a deposit of $1000 at the end of each month for the next 12 months (starting at the end of January). Interest is calculated and added to his account at the end of each month (before the $1000 deposit is made). The monthly interest rate depends on the amount A in his account at the time interest is calculated, in the following way:

$$\begin{aligned} A \leq 1\ 10\ 000 &: \quad 1\% \\ 1\ 10\ 000 < A \leq 1\ 25\ 000 &: \quad 1.5\% \\ A > 1\ 25\ 000 &: \quad 2\% \end{aligned}$$

Write a program that displays, under suitable headings, for each of the 12 months, the situation at the end of the month as follows: the number of the month, the interest rate, the amount of interest, and the new balance. (Answer: Values in the last row of output should be 12, 0.02, 2534.58, 130263.78.)