E 7
Midterm Exam
1:10 – 2:00pm; March 13, 2013

Closed Everything

You may only have out a #2 pencil, eraser, and your scantron form

Exam Version:
D

The exam consists of 28 questions of equal weight.

1. How many times will the following loop execute?

```
>> x = 5;
>> while x < 10
>>    y = y + 3*x;
>> end
```

(a) 1

(b) 0

(c) 2

(d) 10

(e) ∞

2. What is the variable C equal to after the following lines are executed?

```
>> A = [1 4 6];
>> B = [9 6 4];
>> C = A + B;
```

(a) [1 4 6]

(b) [9 6 4]

(c) 10

(d) These lines will not execute; Matlab will have an error.

(e) [10 10 10]

3. After running the following script, what will the value of X be?

```
X = 7;
if X > 8
   X = 10;
elseif X > 9
   X = 17;
else
   while X ~= 1
      X = X-1;
   end
end
```

(a) 7

(b) 10

(c) 17

(d) 0

(e) None of the above.

4. Consider following statement and its output:

```
>> disp(x);
    1    2    3    4    5    6    7    8    9    10
```

How could x have been set?

I   x = 1:10
II x = linspace(1,10,10)
III x = logspace(0,1,10)

(a) Only I

(b) Only II

(c) Only III

(d) I and III only

(e) I and II only

5. What is the value of **x** after this program runs?

```
x = 18;
y = 5;
while x >= y
  x = x - y;
end
```

(a) 3

(b) 18

(c) 5

(d) 0

(e) 8

6. Consider the following statements

```
>> A = 1:100;
>> A(end)
```

What will be their output?

(a) 100

(b) An error saying **end** is not defined

(c) The numbers from 1 to 100 printed in order

(d) 101

(e) None of the above

7. Consider a script with the following lines. What will happen when the script is run?

```
1  S.str = 'Student X';
2  S.cell = 5551212;
3  S.var = 7;
4  S(str)
```

(a) Only Student X will print to the screen

(b) Only 7 will print to the screen

(c) Matlab will have an error when trying to execute line 2.

(d) Matlab will have an error when trying to execute line 4

(e) Both (c) and (d)

4

8. What will the value of R be after the following lines are executed?

```
1 >> Q = true;
2 >> P = 1 < 0;
3 >> R = (~Q || ~P) && Q;
```

(a) Matlab will have an error on line 1

(b) `false`

(c) Matlab will have an error on line 2

(d) `true`

(e) Matlab will have an error on line 3

9. Consider the following function:

```
function A = f(B)
    A = B^2;
end
```

If one types

```
>> A = 7;
>> B = 3;
>> B = f(A);
```

What will the value of the variable A be in the workspace after all the lines finish executing.

(a) 9

(b) 49

(c) 7

(d) 3

(e) None of the above

5

10. Consider the `diceset` class definition from Assignment 5. We would like to add a method to the class definition that totals up the values on the dice in the set.

```
classdef diceset
    properties (Access=protected)
        dice;
        sides;
        vals;
    end

    methods
        function d = diceset(dice,sides,initvals)
            d.dice = dice;
            d.sides = sides;
            d.vals = initvals(1:dice);
        end

        function disp(dset)
            disp(dset.vals);
        end

        function dset = roll(dset)
            dset.vals = randi(dset.sides,1,dset.dice);
        end

        function vals = getVals(dset)
            vals = dset.vals;
        end

        function total = sumVals(dset)
            % method body
        end
    end
end
```

Which of the following are correct replacements for % *method body*?

(I)
```
total = 0;
for i=1:dset.dice
    total = total + dset.vals(i);
end
```

(II)
```
total = sum(dset.vals);
```

(III)
```
total = sum(getVals(dset));
```

6

(a) I only

(b) II only

(c) III only

(d) I and II only

(e) I, II, and III

11. Which expression properly defines the function $f(s) = 3s^3$?

```
I    f = @(s) 3*s^3;
II   f = @(x) 3*x^3;
III  f = 3*x^3;
```

(a) Only I

(b) Only II

(c) Only III

(d) I and II only

(e) I, II, and III

12. Consider the following function definition

```
function f(x)
   y = x*x )
end
```

What will happen when the statement below is executed at the command prompt?

```
>> f(3);
```

(a) Matlab will have an error, because y is undefined in the command window.

(b) The line will execute, 'y = 9' will print in the command window, and y will be undefined in the workspace.

(c) The line will execute, 'y = 9' will print in the command window, and y will have the value 9 in the workspace.

(d) Matlab will have an error, because the function f(x) has no return arguments.

(e) None of the above.

13. Consider the following function

```
function y = f(x)
  if x == 1
    y = 1;
  else
    f(x-1) + x )
  end
end
```

What will the value of the variable y be in the command window workspace after the following statements are executed

```
>> x = 3;
>> y = f(x)
```

(a) 6

(b) 5

(c) 1

(d) Matlab will have an error

(e) None of the above

14. The following function represents which mathematical operation?

```
function out = s(n)
  if n == 1
    out = 2;
  else
    out = 2*n^2 + s(n-1);
  end
end
```

(a) $2n^2$

(b) $\sum_{k=1}^{n} 2k^2$

(c) $\sum_{k=0}^{n} n^2$

(d) $\prod_{k=1}^{n} 2k^2$

(e) $\sum_{k=1}^{n} s(k)$

15. What will occur if a script with the following lines is executed?

```
1  vals = 1:50;
2  vals = vals( vals > 25 );
3  disp(vals);
```

(a) The script will run but there will be no output since each line is terminated by a semi-colon.

(b) The script will throw an error when it tries to execute line 2.

(c) The word `vals` will print in the command window.

(d) The script will throw an error at line 3 because `disp` is not a valid method for objects of class `double`.

(e) The numbers from 26 to 50 will print in the command window.

16. Consider the following function:

```
function out = mySummer(f,tol)
  out = 0;
  k = 1;
  nextTerm = f(k);
  while abs(nextTerm) > tol*abs(out)
    out = out + nextTerm;
    k = k + 1;
    nextTerm = f(k);
  end
end
```

If the following statements are issued at the command prompt

```
1  >> g = @(z) z^-3;
2  >> mySummer(g,10^-5)
```

which of the following statements are true?

(a) Matlab will produce an error when line 2 is executed

(b) Matlab will enter an infinite loop when line 2 is executed

(c) Matlab will produce an error when line 1 is executed

(d) 0 will be output in the command window

(e) None of the above

17. What is the big-O run time complexity of the following function in terms of n?

```
function out = fnc(n)
  if n == 1 || n == 2
    out = 23;
  else
    out = fnc(n-1) + fx(n-2);
  end
end
```

(a) $O(n)$

(b) $O(\log n)$

(c) $O(2^n)$

(d) $O(23)$

(e) All of the above

18. Consider the following function

```
function [b] = fnc(f,x)
  b = f(x)+f(x);
end
```

What will the output of the following expression be?

```
>> fnc(@(y) y*y, 6)
```

(a) The expression will not run; it will cause an error to occur.

(b) 12

(c) 72

(d) b

(e) None of the above

Questions 19–21: Consider the following recurrence relation:

$$T(y) = 3\,T(y/5) + 6\,T(y/7)$$
$$T(y) = 4 \text{ for all } y \leq 1$$

and the following *incomplete* program for evaluating it:

```
1  function [out] = T(z)
2    if z
3      % Base Case
4    else
5      % Recursive statement
6  end
```

19. What is the proper completion for line 2?

    (a) `y <= 1`

    (b) `z == 1`

    (c) `z <= 1`

    (d) `z == baseCase`

    (e) None of the above

20. What is the proper completion for line 3?

    (a) `out = 4;`

    (b) `z = 4;`

    (c) `out == 4;`

    (d) `T = 4;`

    (e) None of the above

21. What is the proper completion for line 5?

    (a) `T = 3*T(y/5) + 6*T(y/7);`

    (b) `out = 3*T(y/5) + 6*T(y/7);`

    (c) `out = 3*T(z/5) + 6*T(z/7);`

    (d) `T = 4;`

    (e) None of the above

Questions 22–24 refer to the following function:

```
1   function [list1,list2] = fnc(listIN)
2   % Usage: [list1,list2] = fnc(listIN)
3   % Inputs: listIN -- list structure with root, node().next, node().value
4   % Output: list1 -- a list structure
5   %         list2 -- a list structure
6
7     cnt = 0;
8     pointer = listIN.root;
9     while pointer ~= 0
10      cnt = cnt + 1;
11      pointer = listIN(pointer).next;
12    end                    node
13
14    mid = listIN.root;
15    for i = 1:floor(cnt/2)
16      mid = listIN.node(mid).next;
17    end
18
19    list1 = listIN;
20    list1.root = listIN.root;
21    list1(mid).next = 0;
22
23    list2 = listIN;
24    list2.root = listIN.node(mid).next;
25
26  end
```

22. After executing lines 7–12, the variable `cnt` represents

    (a) The length of the `listIN.node` structure array

    (b) The index of the last entry in the list `listIN`

    (c) The number of entries in the list `listIN`

    (d) Both (a) and (c)

    (e) None of the above

23. After executing lines 14–17, the variable `mid` represents

    (a) The index of a node approximately halfway through list `listIN`.

    (b) Approximately `length(listIN.node)/2`.

    (c) The index for the root of list `list1`

    (d) The index for the root of list `list2`

    (e) None of the above

24. Which statement is true?

    (a) The two output lists are the same as the input list.

    (b) The root of `list1` is the same as the root of `list2`.

    (c) `list1` is equal to the first half of `listIN` and `list2` is equal to the second half of `listIN`.

    (d) `list2` does not have a properly terminated end node.

    (e) None of the above are true.

Questions 25–28 refer to the following class definition:

```
classdef Time

  properties (Access = protected)
    myHrs  % Hours —— integer
    myMin  % Minutes —— integer < 60
    mySec  % Seconds —— integer < 60
  end

  methods
    function T = Time(h,m,s)
      % Implementation not shown
    end

    function T = resetTime(T,h,m,s)
      % Implementation not shown
    end

    function T = increment(T)
      % Implementation not shown
    end

    function T = addTimes(T1,T2)
      % Implementation not shown
    end

  end
end
```

25. Which of the following represents a correct implementation of the constructor?

(a)
```
T.myHrs = h;
T.myMin = m;
T.mySec = s;
```

(b)
```
myHrs = h;
myMin = m;
mySec = s;
```

(c)
```
T.myHrs = 0;
T.myMin = 0;
T.mySec = 0;
```

(d)
```
T = Time(h,m,s);
```

(e)
```
resetTime(T,h,m,s);
```

26. Which of the following represents a correct implementation of the method `increment`, which increments the time by 1 second?

(I)
```
T.mySec = T.mySec + 1;
```

(II)
```
mySec = mySec + 1;
```

(III)
```
T.mySec = T.mySec + 1;
if T.mySec == 60
  T.mySec = 0;
  T.myMin = T.myMin+1;
  if T.myMin == 60
    T.myMin = 0;
    T.myHrs = T.myHrs + 1;
  end
end
```

(a) I only

(b) II only

(c) III only

(d) I and II only

(e) I, II, and III

27. Consider the following *incorrect* implementation of the method `addTimes`

```
1  function T = addTimes(T1,T2)
2    h = T1.myHrs + T2.myHrs;
3    m = T1.myMin + T2.myMin;
4    s = T1.mySec + T2.mySec;
5
6    if s >= 60
7        m = m + 1;
8        s = s - 60;
9    end
10
11   if m >= 60
12       h = h + 1;
13       m = m - 60;
14   end
15
16   T.h = h;
17   T.m = m;
18   T.s = s;
19 end
```

The error with this implementation is that

(a) The properties of `T1` and `T2` have been incorrectly accessed.

(b) Matlab will have errors on lines 16,17, and 18 because one can not have structure field names with the same name as a local variable.

(c) The output object `T` has not been properly instantiated. One needs to call the contructor to create `T` from `h, m, s` instead of lines 16,17, and 18.

(d) All of the above

(e) None of the above

28. Consider a script with the following lines (assume a correct implementation of the constructor and addTimes):

```
1  T1 = Time(5,0,1);
2  T2 = Time(1,1,1);
3  T3 = addTimes(T1,T2);
4  T3.myHrs
```

When line 4 executes the output will be

(a) 6

(b) A Matlab error

(c) [6 1 2]

(d) myHrs

(e) None of the above