SAMPLE PLACEMENT TEST FOR COMPUTER SCIENCE

1. An algorithm for a clock display must count the hours from 1 through 12 repeatedly. Which of the following pseudocode samples does this task correctly? Assume "n mod i" means the remainder when n is divided by i.

   (a) hour = 1
   ```
   repeat
       hour = (hour + 1) mod 12
   until forever
   ```
   (b) hour = 1
   ```
   repeat
       hour = (hour mod 12) + 1
   until forever
   ```
   (c) hour = 1
   ```
   repeat
       hour = (hour + 1) mod 13
   until forever
   ```
   (d) none of the above

2. Assume $sum(a, b)$ adds a and b while $prod(a, b)$ multiplies a and b. What is $prod(sum(a, c), sum(a, prod(c, d)))$?

   (a) $a^2 + ac(1 + d) + c^2d$
   (b) $a + ca + cd$
   (c) $(a + c)a + cd$
   (d) none of the above

3. The teacher gives this hint for a true/false quiz: "It is not true that both exercise 1 is not true and that exercise 2 is not false." Which of the following statements must be incorrect?

   (a) Both exercises 1 and 2 are true.
   (b) Only exercise 2 is true.
   (c) Neither exercise is true.
   (d) Only exercise 1 is true.

4. If $X_1 = 1$ and $X_2 = 1$ and, in general, $X_{i+2} = X_i + X_{i+1}$, then what is X_4?
   (a) 1
   (b) 2
   (c) 3
   (d) 4
5. Which of the following algorithms does *not* correctly sort a stack of numbered cards in decreasing order?
   (a) While stack is not empty
       Find card with smallest value
       Place this card on a second stack
   (End of stuff to repeat)
   The second stack is now sorted.
   (b) While stack is not empty
       Take the top card
       Insert this card in its proper position in a second stack
   (End of stuff to repeat)
   The second stack is now sorted.
   (c) If the stack has at least 2 cards
       Split stack in half (or nearly so if number is odd)
       Apply this algorithm to each of these two stacks
       Merge the two stacks back into one sorted stack
   (End of stuff to repeat)
   (d) All of the above are correct algorithms
6. Which of the following statements is saying the same thing as this quote: "Only if Jim is at least 13 and Sue is not dating anyone else, then Jim and Sue may go out together."
   (a) If either Jim is less than 13 or Sue is dating someone else, then Jim and Sue may not go out together.
   (b) If it is not the case that "Jim is less than 13 and Sue is dating someone else", then Jim and Sue may go out together.
   (c) If it is not the case that "Either Jim is less than 13 and/or Sue is dating someone else", then Jim and Sue may not go out together.
   (d) All of the above are the same.

7. While the sun is shining
        Play outside 1/2 hour
        Check on your brother
    (End of stuff to repeat)
    Fetch your brother
    Come inside

    Repeat the following:
        Play outside 1/2 hour
        Check on your brother
    Until the sun is not shining
    Fetch your brother
    Come inside

    Under what conditions do the two code segments yield different results?

    (a) Starting time is an hour before sunset.
    (b) Starting time is 15 minutes before sunset.
    (c) Starting time is 15 minutes after sunset.
    (d) Results are always the same.
    (e) Results are always different.

8. Instructions for Tom:

    Erase anything in box A and write 5 in the box.
    Erase anything in box B and write 3 in the box.
    Copy the value from box A to box D.
    Copy the value from box B to box E.
    Add the values in boxes D and E.
    Erase anything in box C and write the sum in the box.

    Instructions for Pam:

    Erase anything in box B and write 7 in the box.
    Erase anything in box A and write 6 in the box.
    Copy the value from box A to box F.
    Copy the value from box B to box G.
    Add the values in boxes F and G.
    Erase anything in box C and write the sum in the box.

    Assume Tom and Pam start at about the same time, and may progress at different rates through the instructions. However, if one of them is erasing and writing a new value in a particular box, the other must wait until the change is completed. When both Tom and Pam are finished, what are all the numbers that might be found in box C?

    (a) 8 or 13
    (b) 10 or 11
    (c) 8 or 9 or 13
    (d) 8 or 9 or 12 or 13
    (e) None of the above

9. Assume X and Y are non-negative integers. Does this algorithm always correctly compute the product?

```
Product = 0
Repeat the following:
    Product = Product + Y
    X = X - 1
Until X = 0
```

(a) Always correct

(b) Sometimes correct

(c) Never correct

10. Sam sets plates to be washed on a stack. Kim takes plates from the stack and washes them. They may work at different speeds so the stack may grow and shrink. Assume that at some point Sam puts a red plate on the stack, sometime later an orange plate, still later a yellow plate, and later yet a green plate. Otherwise all the plates are white. What order of washing the plates would be impossible?

(a) red, orange, yellow, green

(b) green, yellow, orange, red

(c) yellow, orange, red, green

(d) orange, green, red, yellow

(e) All the above sequences are possible.

11. Algorithm Swaptest

```
Algorithm Swaptest
    A = 3          box A: [3]
    B = 7          box B: [7]
    Call swap(A,B)
    Print A, B
End Algorithm
```

```
Procedure swap(X,Y)
    T = X
    X = Y
    Y = T     box T: [?]
End Procedure
```

Here are two definitions of the command "Call swap(A,B)":

1 Make a new box named X and copy the value from A into it. Make a new box named Y and copy the value from B into it. Perform procedure swap.

2 Make X a new name for box A (so both A and X refer to the same box.) Make Y a new name for box B (so both B and Y refer to the same box.) Perform procedure swap.

Which definition(s) result in having box A with a 7 and box B with a 3?

(a) Definition 1

(b) Definition 2

(c) Both definitions

(d) Neither definition

12. Algorithm AverageTest

```
Algorithm AverageTest
    A = 3            box A: [3]
    B = 7            box B: [7]
    C = Average(A,B)
    Print A, B
End Algorithm
```

```
Function Average(X,Y)
    X = X + Y
    Send back value X/2
End Function
```

Here are two definitions for evaluating "Average(A,B)":

1 Make a new box named X and copy the value from A into it. Make a new box named Y and copy the value from B into it. Perform function Average.

2 Make X a new name for box A (so both A and X refer to the same box.) Make Y a new name for box B (so both B and Y refer to the same box.) Perform function Average.

Which definition(s) result in having A remain 3, B remain 7, and C being the correct average of 5?

(a) Definition 1

(b) Definition 2

(c) Both definitions

(d) Neither definition

13. In the following procedure assume n is the height in inches of your nose above water.

Procedure GoDeeper(n)
Print “My nose is ” n “ inches above water!”
If n $\geq$ 1 then call GoDeeper(n-1)
Print “My nose is ” n “ inches above water!”
End Procedure

Define “call GoDeeper(n-1)” as follows: Make a new box named n, even if there already is a box(es) named n. Copy the value from the currently used box n minus 1 into the new box n. Perform procedure GoDeeper using the new box n. When this call is completed, resume performing the previous call with its copy of box n.

Given the command “call GoDeeper(n-1)” with n having value 5, what is the value on n each time the message is printed?

(a) 4 3 2 1
(b) 4 3 2 1 0
(c) 4 3 2 1 0 0 1 2 3 4
(d) 0 1 2 3 4
(e) None of the above will be printed.

14. There are factories for building robots, robodogs, and robocats. Robots, robodogs, and robocats may be given names. Robots may have pets, but no more than one at a time. Robodogs and robocats can roll over, sit, and beg. Here are some guidelines to follow in this exercise:

- **Build robot**: The robot factory builds a new robot.
- **robot R1**: R1 may be used to refer to a robot, but is not necessarily its name.
- **R1 = Build robot**: R1 now refers to an actual robot, but R1 in not necessarily its name.
- **R1.pet.name**: This is more easily read by replacing each “.” with “’s ”. So this example designates R1’s pet’s name, i.e. the name of R1’s pet, assuming robot R1 has a pet!
- **R1.pet.beg!**: The “!” means the last word is a command. So in this example, robot R1’s pet is being commanded to beg.

- **R2.pet = R1.pet**: Assuming R2 designates another robot, this makes robot R1's pet also be robot R2's pet. (They share the pet!) But note that if R2 already has a pet, it will release it before new pet is claimed. You may assume that a robot always keeps its pet on a leash, and in the case of a shared pet, the pet may have several leashes clipped to it!
- **R1.name = "Jim"**: Robot R1 now has a real name! And that name is Jim.

Consider the following sequence of instructions. At their completion, are there any stray robopets?

robot R1, R2
R1 = Build robot
R2 = Build robot
R1.name = "Jim"
R2.name = "Sam"
R1.pet = Build robocat
R1.pet.name = "Muffy"
R1.pet.name = "Whiskers"
R2.pet = R1.pet
R2.pet.name = "Fluffy"
R1.pet = Build robodog
R1.pet.name = "Spot"
R1.pet.beg!
R2.pet = R1.pet

(a) Yes, Fluffy is now a stray.
(b) Yes, Spot is now a stray.
(c) Yes, Muffy is now a stray.
(d) Yes, Muffy and Whiskers are now strays.
(e) No, there are no strays.

15. Using the same sequence of instructions as in the previous exercise, how many robopets are there in all?

(a) 2
(b) 3
(c) 4