CSE 142 Midterm #2
May 5, 2001
All multiple choice questions are equally weighted. You can generally assume that code shown in the questions is syntactically correct, unless something in the question or one of the answers suggests otherwise. The questions are not intended to require knowledge of advanced or obscure C language features not mentioned in CSE142.

1. Pick the true statement.

A. "Functional decomposition" is a technique for designing a program.
B. "Functional decomposition" refers to the natural decay of a program over its lifetime.
C. A "static call graph" shows all the internal detail of the functions in a program.
D. One reason symbolic constants (#define symbols) are desirable is because they don't have to conform to the same naming rules as other identifiers.
E. Comments describing how functions work allow the compiler to double-check your function.

2. What is printed by the following code? (The variables are integers).

```
#define TRUE    1
#define FALSE  0
...
a = 1;
b = 6;
c = 5;
status = ((c / b) || (a * b)) && ((c - b / a) * c);
printf("%d", status);
```

A. 0
B. 1
C. 5
D. TRUE
E. FALSE

3. Look at the following code, and determine what value is printed.

```
int trace1=0, trace2=0;

for (j=0; j < 4; j = j+1) {
        for (k=0; k < 2; k = k+1) {
                trace1++;
        }
        trace2++;
}
printf ("%d", trace1+trace2);
...
```

A. 4
B. 6
C. 8
D. 12
E. 15

4. What is the ouput of the following code? Assume all variables are integers.

```
if ((a > 5) && (a <= 5))
    printf("Sonics\n");
if ( !( (b == 2) || (b != 2) ) )
    printf("Mariners\n");
else
    printf("Seahawks\n");
```

A. Mariners

B. Seahawks

C. Mariners
Seahawks

D. Sonics
Mariners
Seahawks

E. unable to determine: depends on the values of a and b

5. In the ancient days (summer of 1978), worldwide oil shortages led to long lines at gas stations. Certain professions had special privileges and did not have to wait in these lines. In particular, police officers, firefighters and doctors were given these privileges --but professors were not!.

Read the following code, then choose the correct conditiona so that the code will properly assign privileges to the above mentioned professions.

```
     #define POLICE    1
        #define DOCTOR  2
        #define FIREFIGHTER 3
        #define PROFESSOR 4
        ...
        char privileged;
        int profession;
          ...

        if (        ???        ) /*choose the conditional needed
here*/
        {
            privileged = 'Y';
        }
        else
        {
            privileged = 'N';
        }
        ..
```

A. `profession == POLICE || FIREFIGHTER || DOCTOR`

B. `profession == POLICE && FIREFIGHTER && DOCTOR`

C. `profession = POLICE || profession = FIREFIGHTER || profession = DOCTOR && profession != PROFESSOR`

D. `profession == POLICE || profession == FIREFIGHTER || profession == DOCTOR`

E. `profession == POLICE && profession == FIREFIGHTER && profession == DOCTOR && profession != PROFESSOR`

6. Study this program, and determine: What would the printf in main produce?

```
void f1 (int i, int j)
{
   i = i + 1;
   j = j - 1;
}

int f2 (int i, int j)
{
   i = i + 1;
   j = j - 1;
   return (i + 2);
}

int main (void)
{
   int i, j;
   i = 4;
   j = 5;
   f1(j, i);
   j = f2(i, j);
   i = f2(j, i);
   f1(i, j);
   printf("i is %d, j is %d\n", i, j);
   return 0;
}
```

A. `i is 4, j is 10`
B. `i is 7, j is 5`
C. `i is 10, j is 7`
D. `i is 5, j is 7`
E. `i is 4, j is 5`

7. What would the following program fragment output?

```
...
int main (void)
{
   int i, j = 1;
   for (i = 3; i > 1; i = i - 1) {
         j = j + 5 * i;
   }

   printf("%d ", j);
}
```

A. 16 26 31
B. 16 26
C. 26
D. 31
E. The loop will not stop running.

8. Which call graph is best to describe the following algorithm that helps schedule transportation pick-ups:

The main program asks the user for the position they want to be picked up at, and then computes the cost. When asking for the position, the program will check to see if the position is in the bounded area. As part of computing the cost, the program asks users for type of transaction (bus, cargo) and uses an appropriate function to compute the cost.

[printf/scanf are omitted from the call graphs for this problem.]

A.

```
                         main

                 /      /           \                  \        \
      get_position computer_cost check_bounded_area bus_cost cargo_cost
```

B.

```
                 main
                /    \
       get_position    compute_cost
          |               /     \
    check_bounded_area  bus_cost  cargo_cost
```

C.

```
                  main
                 /    \
       compute_cost    get_position
            |              /    \
  check_bounded_area  bus_cost cargo_cost
```

D.

```
                 main
                   |
              get_position
                 /      \
    check_bounded_area  compute_cost
                  /    \
           bus_cost  cargo_cost
```

E. None of the above choices even remotely describes the given algorithm.

9. Here's a truth table that is not completely filled in. A and B stand for any conditional expressions. Fill in the ((!A) || B) column, then pick the matching answer. (Hint: it might help you to add an intermediate column.)

A	**B**	**((!A) || B)**
T	**T**	
T	**F**	
F	**T**	
F	**F**	

A. T
F
T
T

B. F
T
F
F

C. F
T
F
T

D. T
T
F
T

E. F
F
F
F

10. At /* Point A*/ in the program, what is the value of the variable arrow?

```
...
void converge (int * target) {
     if (*target > 0)
          *target  = *target -1;
     else
          *target = *target +1;
}
...
int arrow=0;
converge (&arrow);
converge (&arrow);
converge (&arrow);
/* Point A */
```

A. -2
B. -1
C. 0
D. 1
E. 2

11. Given the function definition below, what does the following statement print out?

```
 switchAndPrint(2);

------------------------------
void switchAndPrint(int x)
{
  switch(x)
  {
  case 1:
    printf("1");
    break;
  case 2:
    printf("2");
  default:
    printf("3");
    break;
  }
}
```

A. 1
B. 2
C. 3
D. 23
E. 123

12. Study the following function testForDivisors, which is given without comments, but which does in fact have something to do with the divisors of an integer.

What value is returned by this function when it is called with an argument value of 14?

```
int testForDivisors(int x)
{
  int nD = 0;
  int testNumber;

  for(testNumber = 2; testNumber < x; testNumber++) {
      if(x % testNumber == 0)
          nD++;
  }
  return nD;
}
```

A. 0
B. 2
C. 10
D. 11
E. 14

13. Which C condition captures the meaning of the English-language phrase "P or Q but not both"?

A. (P || !Q) && (!P || Q)
B. (P || !P) && (Q || !Q)
C. (P || Q) || (!P || !Q)
D. (P || Q) && !(P || Q)
E. (P && !Q) || (!P && Q)

14. Examine this code fragment, and determine the value of rain[0] after the last statement shown.

```
int rain[4]; /*declares an array of 4 integers.
    The elements are rain[0], rain[1], rain[2], and rain[3] */
int i;

for (i=0; i < 3; i=i+1) {
     rain[i] = 1;
}
rain[0] = rain[1] + rain[2];
/* What is rain[0] now?? */
```

A. 0
B. 1
C. 2
D. 3
E. 4

15. In a game program, "bullets" are displayed as moving circles. A function computes new coordinates for the center of a bullet, given its current position and "offset" (distance being moved); the function also tells whether or not the bullet is fully visible on the screen after being moved. The function does no I/O. Chose the function prototype which would be most appropriate for this task.

A.
```
void moveBullet (double radius, int oldX, int oldY, int XOffset,
int YOffset, int newY, int newY);
```
B.
```
int moveBullet (double radius, int oldX, int oldY, int XOffset,
int YOffset, int * newX, int * newY);
```
C.
```
void moveBullet (double radius, int oldX, int oldY, int XOffset,
int YOffset, int * newX, int * newY, int isOnScreen);
```
D.
```
int moveBullet (double radius, int oldX, int oldY, int XOffset,
int YOffset, int * newX, int * newY, int isOnScreen);
```
E.
```
(int newX, int newY, int isOnScreen) moveBullet (double radius,
int oldX, int oldY, int XOffset, int YOffset);
```

16. [worth 5 M.C. questions] A cryptography algorithm requires a pair of prime integers. To be a "valid pair", two numbers must be prime, must be different from one another, and there must be no primes between the two.

Your task: write a function which, given any two integers, determines whether they constitute a valid pair.

You may not call any functions at all (no, not printf and not scanf!), except the following one:

```
int isPrime (int num);
       /*returns 1 if num is prime, 0 otherwise*/
```

You are not asked to implement isPrime.

Part of your task is to determine appropriate parameters and return type (if any) of the function. Include comments to describe what these are (but you can assume the reader of your code is familiar with the definition of "valid pair"). Use your best style.

Some examples of valid or invalid pairs:

15	**17**	**is not valid, because 15 is not prime.**
13	**19**	**is not valid, because there is a prime (17) between 13 and 19.**
17	**19**	**is valid.**
31	**29**	**is valid**
31	**31**	**is not valid (the numbers must be different)**

Start your code here and continue on the next page if necessary.

[continue on this page if needed]