Because of the large class size, we won't be able to answer questions during the exam, so please make your best guess on each question. Thanks for a pleasant semester and enjoy your summer!

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1. What is the output of this code:

```
double value = 44.5;
cout << value;
```

A) 44 B) 44.5 C) cout D) value

2. How many lines of output will this code produce?

```
int x = 8;
if (x < 5)
        cout << "x is bigger than 5" << endl;
        cout << "Make it so!" << endl;
cout << "engage" << endl;
```

A) 0 B) 1 C) 2 D) 3

3. What number does this code print?

```
int x,y;
x = −1;
y = 0;
while (x <= 3)
{
        y += 2;
        ++x;
}
cout << y;
```

A) 2 B) 6 C) 8 D) 10

4. What number does this code print?

```
double tax = 0.0;
double total = 2.0;
if (total > 2.5)
{
        tax = 0.5;
}
cout << total + total * tax;
```

A) 0 B) 2 C) 2.5 D) 3 E) 4

5. Which of these Boolean expressions always has the same truth value as (!x || !y)?

A) !(!x && !y) B) !(!x || !y) C) !(x && y) D) (!x && !y) E) !(x || y)

6. What is the value of x after this statement?
   double x = 19/4;
   A) 3 .0 B) 4.0 C) 4.75 D) 76.0

7. What is the value of x after this statement?
   int x = 3 % 4;
   B) 0 B) 0.75 C) 1 D) 3 E)4

8. Which of these is a difference between C++ and Ruby?
   A) Ruby's compiler verifies all assert statements (or the Ruby equivalent) at compile time.
   B) Ruby does not require a variable to have the same data type throughout the program.
   C) Ruby has a string class built in.
   D) Ruby has BGI graphics built in (so that #include <graphics.h> is not required).
   E) Ruby is purely functional (no assignment statements).

9. Which of these C++ features is not available in C?
   A) cin and cout
   B) for loops (C has only while loops)
   C) The unsigned int data type
   D) Value parameters

10. What will the function call mystery(425) print?

```
void mystery(unsigned int x)
{
        if (x < 10)
        {
                cout << x;
        }
        else
        {
                mystery(x/10);
                cout << x % 10;
        }
}
```

   A) 4 B) 5 C) 42 D) 425 E)524

11. You should make a parameter be a reference parameter…
   A) Always.
   B) When any of the other parameters is a reference parameter.
   C) When you need to be able to change the value of the parameter in the function but not have this affect the actual argument.
   D) When you need to be able to change the value of the actual argument.

12. Consider the following function definition:

```
void ic(int& a, int b)
{
        int temp = a;
        a = b;
        b = temp;
}
```

What is the output of this code fragment?

```
int x = 40, y = 60;
ic(x,y);
cout << x << " and " << y;
```

A) 40 and 40 B) 40 and 60 C) 60 and 40 D) 60 and 60

13. Suppose you are running a selectionsort algorithm to sort an array from smallest to largest. So far, the loop has executed 3 times. Which of these arrays could show the state of the array at this point?
    A) 1 2 3 4 5 6
    B) 1 2 5 3 4 6
    C) 1 3 4 2 5 6
    D) 1 4 3 5 2 6

14. Suppose you are running a binary search algorithm to determine whether a specified number appears in an array. Which of these conditions must hold for the array?
    A) The array contains only unsigned numbers.
    B) The array is sorted.
    C) The array was created recursively.
    D) The length of the array is an exact power of two.
    E) The length of the array is an exact square (such as 1, 4, 9, 16, 25…).

15. Suppose you are running a binary search algorithm to determine whether the number 42 is in this array:
    { 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160}
    What values could the high and low indexes have after the first iteration of the main loop?
    A) low is 0 and high is 8
    B) low is 0 and high is 14
    C) low is 1 and high is 15
    D) low is 8 and high is 15
    E) low is 8 and high is 16

16. Suppose I call the fillpoly function like this: fillpoly(4, points). How many integers must be in the points array?
    A) 2 B) 4 C) 6 D) 8 E) 16

17. What does the minimax algorithm do when it reaches a leaf in the game search tree?
    A) Determines which player must move next.
    B) Evaluates all the possible moves that the computer could make from that leaf.
    C) Evaluates all the possible moves that the human player could make from that leaf.
    D) Evaluates the state of the game without making any more moves.
    E) Prunes the tree via alpha-beta pruning.

18. Which number is closest to the final value of x after this loop finishes? The function abs computes the absolute value of its argument.

```
double x = 0.8,    error = x – (2*x – 1);
while (abs(error) > 0.001)
{
        x = 2*x – 1;
        error = x – (2*x – 1);
}
```

    A) 0 B) 1 C) 2 D) 4 E) 8

19. What was the meaning of the small arrows (the vector field) that were drawn in the spaceship program this semester?
    A) Each arrow indicated the change in velocity that a ship at that point would experience.
    B) Each arrow indicated the direction that a ship at that point would travel.
    C) Each arrow indicated the direction to the nearest fuel depot.
    D) Each arrow indicated the direction toward the nearest star.

20. Which Boolean expression will be true provided that the score is an odd integer in the range from 10 to 20?
    A) (score > 10) && (score < 20) && (score % 2 != 0)
    B) ((score > 10) && (score < 20)) || (score % 2 != 0)
    C) ((score > 10) || ((score < 20)) && (score % 2 != 0)
    D) (score > 10) || (score < 20) || (score % 2 != 0)

21. What are the first and last valid indexes of an array with size 40?
    A) 0 and 39 B) 0 and 40 C) 1 and 39 D) 1 and 40 E) 1 and 41

22. What is the output of the following code fragment?

```
char myString[5] = {'h', 'e', 'l', 'l', 'o'};
int i;
for (i=0;  i <= 4;  i++)
 {
        cout << myString[(i*2) % 5];
}
```

    A) hello B) elloh C) hloel D) elhlo

23. How many times will this code print the letter M? The variables i and j are both int.

```
for (i = 0; i < 5; ++i)
{
        for (j = 0; j < i; ++j)
        {
                cout << 'M';
        }
}
```

A) 5 B) 10 C) 15 D) 25 E) 36

24. You need to write a while loop that continues until an integer x is in the set {2,3,4,5}. How would the loop be controlled?
    A) while (x > 2 && x < 5)
    B) while (x > 2 || x < 5)
    C) while (x < 2 && x > 5)
    D) while (x < 2 || x > 5)

25. In the bisection algorithm to find a number with a certain property, each iteration of the main function changes the range by
    A) Adding two elements (one to both ends)
    B) Dividing its size by 2
    C) Multiplying its size by 2
    D) Taking its Fourier transform
    E) Trimming two elements (one from either end)

26. What is the primary factor that determines the color of a pixel in the program that draws Mandelbrot's function?
    A) The colors of its four neighbors
    B) The escape-time algorithm
    C) The rotational acceleration
    D) The rotational velocity
    E) Symmetry

27. Ideally, testing your program should be done
    A) As each function is developed.
    B) At the end of the coding phase.
    C) When a problem appears.
    D) Only when your instructor requires it.

28. Consider this function definition:

```
void put(int data[5], int index)
{
    data[index] = 42;
}
```

What value will this program fragment print?

```
int data[5] = {0, 1, 2, 3, 4};
put(data, 2);
cout << data[2];
```

A) 0 B) 1 C) 2 D) 3 E) 42

29. A graphics window is 150 pixels wide, and I have a Cartesian coordinate called x that ranges from -10 to +5. Which is the best formula to compute the corresponding pixel coordinate?
    A) pixelx = int(75*x + 75)
    B) pixelx = int(150*x + 150)
    C) pixelx = int(x/10 - 10)
    D) pixelx = int(x/150 + 75)
    E) pixelx = int(10*x + 100)

30. Consider this function to findthe largest element in an array of N double numbers:

```
int maxima(double data[ ])
{
    double answer = data[0];
     int i;
    for (i=1; i < N; ++i)
    {
            if (_____)
            {
                    _________;
            }
    }
    return answer;
}
```

Which item correctly fills in the first blank?

    A) i-1 < i
    B) data[i-1] < data[i]
    C) answer < i
    D) data[answer] < data[i]
    E) answer < data[i]

31. Which correctly fills in the second blank for the previous problem?

A) answer = i;
B) answer = data[i];
C) i = answer;
D) data[i] = answer;

32. In my spaceship program, I have written a function to alter the position (x,y) of one spaceship. The vx and vy parameter are the velocity in pixels per second, and the global delay constant, DT, is in milliseconds.

```
void move(double& x, double& y, double vx, double vy)
{
        x = _____;
        y = _____;
}
```

Which is the right way to fill in the first blank to compute the new x position of the ship?

A) x + DT * vx / 1000;
B) (x + DT * vx) / 1000;
C) (x + DT * vx + 0.5 * DT * vy / 1000;
D) x + 0.5 * (DT * vx + DT * vy) / 1000;
E) x + DT * vx / 1000 + 0.5 * DT * vy / 1000;

33. I have written a program that uses rand() to provide random integers, but I get the same integers every time I run the program.

A) The most likely cause is a bug in the call to rand().
B) The most likely cause is a bug in the rand() function.
C) The most likely cause is a bug elsewhere in the program.
D) This is correct behavior for the rand() function.