2013 Academic Challenge

COMPUTER SCIENCE TEST - SECTIONAL

This Test Consists of 30 Questions

Computer Science Test Production Team
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GENERAL DIRECTIONS

Please read the following instructions carefully. This is a timed test; any instructions from the test supervisor should be followed promptly.

The test supervisor will give instructions for filling in any necessary information on the answer sheet. Most Academic Challenge sites will ask you to indicate your answer to each question by marking an oval that corresponds to the correct answer for that question. Only one oval should be marked to answer each question. Multiple ovals will automatically be graded an incorrect answers.

Be sure ovals are marked as ● , not ⊙ , ⊕ , ◑ , etc.

If you wish to change an answer, erase your first mark completely before marking your new choice.

You are advised to use your time effectively and to work as rapidly as you can without losing accuracy. Do not waste your time on questions that seem too difficult for you. Go on to the other questions, and then come back to the difficult ones later if time remains.

***** TIME: 40 MINUTES *****

DO NOT OPEN TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO!

WYSE – Academic Challenge
Computer Science Test (Sectional) – 2013

1. Octal (base 8) is used often in computing as it can be used to conveniently represent 3 binary bits at a time. What is the following octal number, 735, converted to decimal?

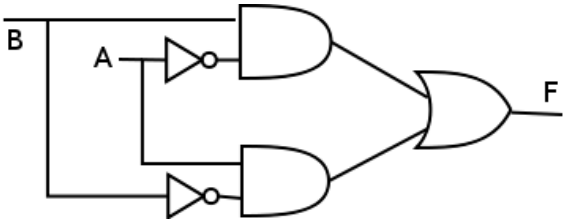
   a. 111011101 b. 477 c. 1337 d. 483 e. None of the above.

2. What is the following floating point binary number, 100011.11, converted to decimal?

   a. 35.3 b. 23.11 c. 23.C d. 35.75 e. None of the above.

3. What is the equivalent logical expression for the following circuit?

   a. (A'B)(B'A)
   b. (A+B')(A'+B)
   c. Always TRUE
   d. A XOR B
   e. None of the above



4. Which of the following is equivalent to the expression below if A is FALSE?

   ```
   (A OR B) AND (not B AND C AND A) AND (C OR not A)
   ```

   a. FALSE b. TRUE c. C d. B AND C e. B

5. Which of the following is the best definition for a compiler?

   a. A program that converts the instructions written in a higher-level computer language to machine code that can later be executed directly by a computer.
   b. A program that finds logic errors.
   c. A special compression protocol for faster network transmission.
   d. A specialized search engine.
   e. A database management system.

6. What is an open source alternative to the Windows operating system?

   a. z/OS
   b. Linux
   c. MacOS
   d. HPuX
   e. DOS

Use the following code for Questions 7, 8, and 9.

```
1     class Ball {
2        public:
3           Ball(float=1.0);
4           float bounce(float) const;
5           float getRadius() const  { return radius; }
6           void setRadius(float r) { radius = (r>0) ? r : 1; }
7           bool operator > (Ball &right) const { return radius > right.radius; }
8        private:
9           float radius;
10    };
11    Ball::Ball(float r) {
12       setRadius(r);
13    }  // end Ball constructor
14    float Ball::bounce(float height)const {
15       float newheight = 0;
16       if (height > 0)
17          newheight = height * 0.75;  // bounces 3 fourths of the height
18       return newheight;
19    } // end bounce method
20
21    class Basketball: public Ball {
22       public:
23          Basketball() { setRadius(4.65); } // inches
24          float bounce (float) const;
25    };
26    float Basketball::bounce(float height) const {
27       float newheight = 0;
28       if (height > 0)
29          newheight = height * 0.8;  // bouncier ball
30       return newheight;
31    } // end Basketball bounce method
```

7. What is the best way to classify the relationship between `Ball` and `Basketball`?

   a. `Basketball` and `Ball` are both sibling classes.
   b. `Basketball` IS-A `Ball` with `Basketball` being the derived class and `Ball` being the base class.
   c. `Basketball` HAS-A `Ball` with both classes being derived classes.
   d. `Ball` IS-A `Basketball` with `Basketball` being the derived class and `Ball` being the base class.
   e. `Ball` and `Basketball` are not related at all.

8. A bounce method exists in `Ball` and a bounce method exists in `Basketball`. What word best relates to the relationship between these two methods?

   a. Encapsulation b. Abstraction c. Overriding d. Overloading e. Destructor

9. What is printed by the following code segment?

```
Ball A;
Basketball B;
(A > B) ? cout << "A is the big ball" : cout << "B is the big ball";
```

a. `A is the big ball`
b. `B is the big ball`
c. The code does not compile due to a syntax error.
d. Cannot be determined from the information provided.
e. `A is the big ballBis the big ball`

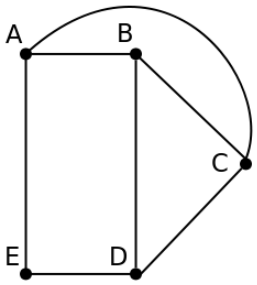
10. Which of the following is not true regarding the quicksort algorithm?

a. The quicksort uses a divide and conquer strategy.
b. The quicksort is implemented using recursion.
c. The more ordered the list is prior to calling it, the worse the quicksort performs.
d. The quicksort has a best case of $O(N\log_2 N)$ performance for N items.
e. The quicksort will always outperform a bubble sort.

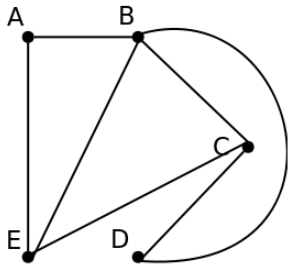
11. Which graph matches the given adjacency matrix?

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \end{bmatrix}$$

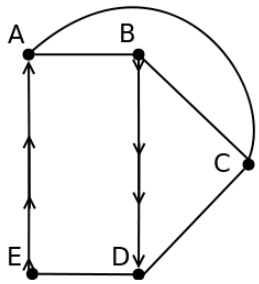
a.



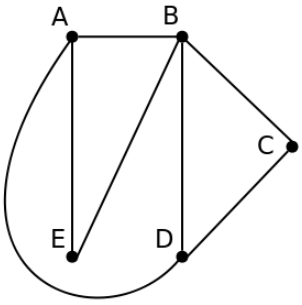
c.



b.



d.



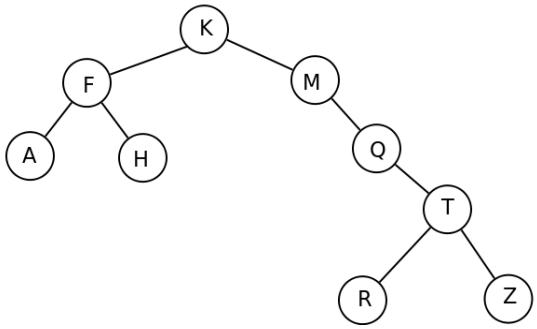
e. The adjacency matrix matches none of the graphs.

12. Using the graphs from the previous problem, which statement below is not true?

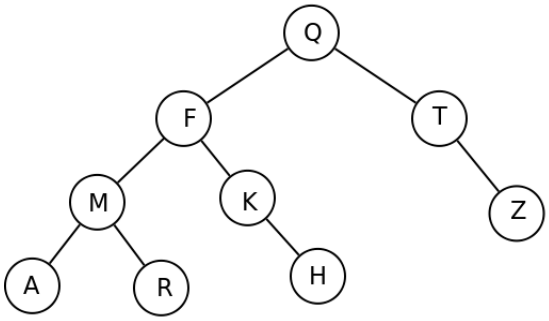
    a. The only graph with directional paths is the graph in answer b.
    b. For node E of answer d's graph, the degree is 2.
    c. All of these graphs are planar.
    d. All of the graphs have 5 nodes.
    e. The adjacency matrix for each graph will be symmetric.

13. Which of the following is not a binary search tree?

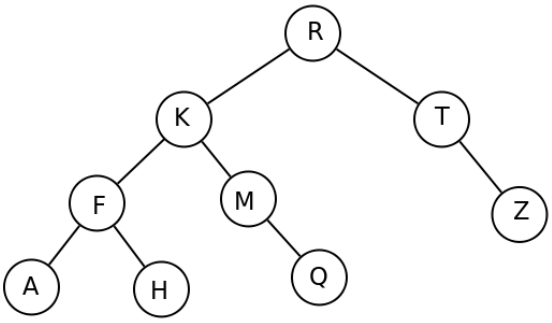
a.



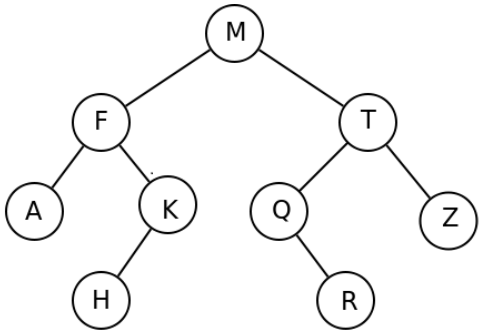
c.



b.



d.



    e. All are binary search trees.

14. Which of the following security protocols is best for securing wireless networks?

    a. WEP b. WPA c. WPA2 d. CRC e. WEP3

15. What is an object that is embedded in a web page, usually invisible to the user, and allows the users activities at a website to be monitored?

    a. A hyperlink
    b. An inline style sheet
    c. An HTML id
    d. An HTML paragraph
    e. A web bug

Use the following code for Questions 16 and 17.

```
1     int add(int a, int b){
2        a = a+b;
3        return a;
4     };
5     int sub(int& a, int b){
6        a = a-b;
7        return a;
8     };
9     int main(){
10       int a = 0;
11       int ans = 0;
12       for (int i=0;i<5;i++) {
13          ans = add(a,i);
14          ans = sub(a,i);
15          cout << i << "  " << a << "  " << ans << endl;
16       }
17    }
```

16. What will be the last line of output from the code?

    a. `4 0 -4` b. `4 -10 -10` c. `5 10 10` d. `4 10 -4` e. None of the above

17. What is the significance of the ampersand on line 5?

    a. It temporarily type casts the variable a as an integer.
    b. It indicates that the variable a is passed by value.
    c. It indicates that the variable a is a global variable.
    d. It indicates that the variable a is passed by reference.
    e. The ampersand has no significance and is only used for documentation.

Use the following code for Questions 18 through 22.

```
1     int my_div (int a, int b=4);
2     int my_mult (int a, int);
3     int main ()
4     {
5        int i, ans;
6        do {
7           cout << "Type a number: ";
8           cin >> i;
9           ans = my_mult(my_div(i,2),2);
10          cout << i << "  " << ans << endl;
11       } while (i!=0);
12       return 0;
13    }
14    int my_div (int a, int b)
15    {
16       if ((a%2)!=0) return my_mult(a,10)/b;
17       else return a/b;
18    }
19    int my_mult (int a, int b)
20    {
21       if ((a%4)==0) return my_div(a);
22       else return a*b;
23    }
```

18. What is the terminology that best describes the code in lines 1 and 2?

    a. Function prototype
    b. Function call
    c. There is not special terminology for this type of code
    d. Function definitions
    e. Function recursion

19. What will cause this program to terminate normally?

    a. The user enters the word “exit”.
    b. The program will stop after 10 iterations of the do-while loop.
    c. It is impossible for this program to terminate normally.
    d. The user enters the number “1000”.
    e. The user enters the number “0”.

20. When `my_div` is called on line 21, what will the value of b be within the `my_div` function?

    a. `4` b. `0` c. `2` d. Undefined e. `10`

21. What will be output when the user enters 4?

    a. `4 2` b. `4 40` c. `4 8` d. `4 4` e. `4 1`

22. What will the output be when the user enters 5?

    a. `5 5` b. `5 25` c. `5 50` d. `5 100` e. `5 1`

Use the following code for Questions 23 through 27.

```
1     int my_func (char a[]) {
2        int i=0;
3        do {
4           i++;
5        } while (a[i] != '\0');
6        return i;
7     }
8     int main ()
9     {
10      char n[30];
11      cin >> n;
12      cout << n << "  " << my_func(n);
13    }
```

23. Which of the following would be invalid input from the user?

    a. Hello
    b. 2*3
    c. 43
    d. \0
    e. All are valid

24. What is the purpose of `my_func`?

    a. To remove any spaces from the array.
    b. To determine how many characters are in the user input string.
    c. To count how many words a user enters.
    d. To validate the user input.
    e. To count spaces in the array.

25. What is the purpose of `'\0'` on line 5?

    a. It is used to check for the end of a string.
    b. It is used to check for two zeroes in a row.
    c. It represents a blank character.
    d. It indicates that the loop needs to be executed while `i` = 0.
    e. It is a syntax error.

26. What will the output be if the user entered the string “Hello”? (the quotation marks would not be entered)

    a. `Hello 5`
    b. `Hello 6`
    c. `5 5`
    d. `5 6`
    e. `5 Hello`

27. What will the output be if the user entered the string “Hello There”? (the quotation marks would not be entered)

    a. `Hello There 11`
    b. `Hello 6`
    c. `Hello There 10`
    d. `Hello 5`
    e. `There 5`

Use the following code for Questions 28, 29, and 30.

```
1    int i;
2    void my_func (int k) {
3       for (int j=k;j<10;j++) {
4          for (i=0;i<10;i++)
5             cout << "Hey";
6       }
7    }
8    int main ()
9    {
10      my_func(4);
11   }
```

28. What is the scope of the variable `i` used on line 4?

    a. Local to the for loop that begins on line 4.
    b. Local to the for loop that begins on line 3.
    c. Local to the `my_func` function.
    d. Global
    e. None of the above

29. What is the scope of the variable `k` used on line 3?

    a. Local to the for loop that begins on line 4.
    b. Local to the for loop that begins on line 3.
    c. Local to the `my_func` function.
    d. Global
    e. None of the above

30. How many times will "`Hey`" be output for the function call `my_func(4)`?

    a. 4 b. 40 c. 100 d. 8 e. 60