



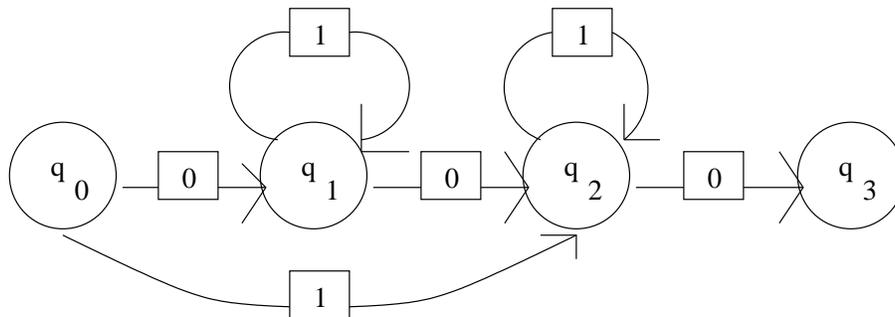
Instructions

Choose the best option of those given. For all questions, “NOTA” means “None Of The Above.” Whenever any code snippets are given, the language is assumed to be the current version of Java.

1. What is the value of y after the following code segment is run?

```
int x = 35; int y = 10;
if (x > 10)
    if (x > 30)
        if (x > 40)
            y = 15;
        else
            y = 20;
    else
        y = 25;
```

- a) 10 b) 15 c) 20 d) 25 e) NOTA
2. Sue and Becky are playing a game at a table with 6 cheese-puffs. A player’s turn consists of eating either 1 or 2 cheese-puffs. The objective of the game is to be the last one to eat a cheese-puff. If both players play optimally, and Sue goes first, who will win?
- a) Sue b) Becky c) Jeff d) Not Enough Information e) NOTA
3. What is the Big O notation for the order of growth in time of the most efficient present day algorithm for sorting a list of length n in ascending order?
- a) $O(n \log n)$ b) $O(n)$ c) $O(n^2)$ d) $O(n^n)$ e) NOTA
4. Given that q_0 is the starting state, and q_3 is the accepting state, which of the following strings will be accepted by the regular expression diagrammed as follows?



- a) 011110 b) 111111 c) 001111 d) 011011 e) NOTA
5. The following code is an example of:

```
Animal pet = new Dog();
pet.eat();
pet.speak();
```

- a) recursion b) casting c) static methods d) polymorphism e) NOTA



6. What would the output of the following statement be?

```
System.out.print("\\\\"\\'\\'");
```

- a) \'"\' b) \\\"\\'\\' c) \\\"\\' d) Syntax Error e) NOTA

7. Given any natural number as input this function will always return what type of number?

```
public int mystery(int num){  
    if (num == 0 || num == 1)  
        return 1;  
    return mystery(num-1) + mystery(num-2);  
}
```

- a) Fibonacci b) Factorial c) Pyramidal d) Digits of π e) NOTA

8. In the limit as `num` goes towards infinity, what number does the return value of this function approach? Assume that `factorial(n)` returns $n!$.

```
public double factorial(int arg){  
    // definition omitted, function returns arg!  
}
```

```
public double mystery(int num){  
    if (num == 0)  
        return 1;  
    return 1 / factorial(num) + mystery(num-1);  
}
```

- a) e b) π c) 1 d) ϕ e) NOTA

9. What famous British mathematician is credited for significant theoretical and actualized devices in computer science, some of which helped the Allies break the German Enigma code in World War II?

- a) Charles Babbage b) Alan Turing c) Richard Sharkey d) John Backus e) NOTA

10. What is the Big O notation for the order of growth in time of function `mystery`?

```
public int mystery(int num){  
    if (num == 0 || num == 1)  
        return 1;  
    return mystery(num-1) + mystery(num-2);  
}
```

- a) $O(n \log n)$ b) $O(n)$ c) $O(n^2)$ d) $O(2^n)$ e) NOTA



11. What types of Strings return true when passed to the following function?

```
public boolean mystery(String in) {  
    if(in.length() < 2)  
        return true;  
    else if(in.charAt(0)==in.charAt(in.length()-1))  
        return mystery(in.substring(1,in.length()-1));  
    return false;  
}
```

- a) Palindromes d) Strings with length greater than two
b) Odd length Strings e) NOTA
c) Even length Strings
12. Converted to decimal, what is the maximum number that can be stored into an 8-bit unsigned integer variable?
a) 127 b) 128 c) 255 d) 256 e) NOTA
13. An example of a programming language in the functional paradigm is:
a) Java b) C c) Pascal d) Lisp
14. What is the height (number of levels) of a binary search tree created by inserting the following integers in the following order?

28, 22, 39, 33, 24, 20, 27, 31, 21

- a) 3 b) 4 c) 5 d) 6 e) NOTA
15. What is the purpose of mystery?

```
public static void mystery ( int [] arr, int i, int j ) {  
    int temp = arr[j];  
    arr[j] = arr[i];  
    arr[i]= temp;  
}
```

- a) Return the first element of **arr** d) Give an error
b) Swap the elements **i** and **j** in the array **arr** e) NOTA
c) There will be no effect on **arr**
16. Given the following pseudocode implementation of a stack, what is the return of the last Pop call?

```
Push 'a'  
Push 'b'  
Push 'c'  
Pop  
Push 'd'  
Pop  
Pop
```

- a) "a" b) "b" c) "c" d) "d" e) NOTA



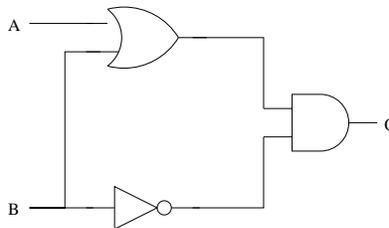
17. An optimally balanced binary search tree has 23 nodes. How many search steps will guarantee a found node?
a) 4 b) 5 c) 6 d) 7 e) NOTA

18. What is the output when the following program is run?

```
public class Testing {  
    public int value = 0;  
    public static void changeValue() {  
        value++;  
    }  
  
    public static void main(String[] args){  
        Testing myTest = new Testing();  
        myTest.changeValue();  
        System.out.println(myTest.value);  
    }  
}
```

- a) 0 b) 1 c) 2 d) 3 e) NOTA

19. For the logic gate given, what possible Boolean value for (A, B) would Q be true?



- a) (true, false) b) (true, true) c) (false, false) d) (false, true) e) NOTA
20. What is the value of the expression $6\ 4\ 5\ +\ \times$, evaluated using reverse Polish notation?
a) 29 b) 26 c) 50 d) 54 e) NOTA
21. The Boolean expression $\text{num} == \text{max} \ ||\ \!(\text{num} \ !=\ \text{max})$ can be simplified to:
a) $\text{num} == \text{max}$ b) $\text{num} \ !=\ \text{max}$ c) True d) False e) NOTA
22. What is the output of `mystery(248)`?

```
public static void mystery(int x) {  
    if(x >= 9)  
        mystery(x / 10);  
    System.out.print(x % 10);  
}
```

- a) 84 b) 24 c) 248 d) 842 e) NOTA

23. Which of the following types is not a primitive data type?
a) int b) boolean c) char d) double e) NOTA



24. What is the output of the following line of code?

```
System.out.print(8/3);
```

- a) 0 b) 2 c) 2.6666667 d) 3 e) NOTA

25. Due to its initial enormous branching factor of 361, what game is the most difficult game for a computer based artificial intelligence program to gain expert status at?

- a) Go b) Chess c) Checkers d) Connect Four

26. What is the output of the following code?

```
for(int x = 0; x < 3; x++) {  
    for(int y = 0; y < 2; y++) {  
        System.out.print(x+y);  
    }  
}
```

- a) 000110112021 b) 011223 c) 010321 d) 0001101120213031 e) NOTA

27. A line or a F.I.F.O. data structure is also known as a(n):

- a) Queue b) Stack c) Heap d) Priority Run e) NOTA

28. What allows Java to run on any operating system?

- a) Universal garbage collection d) Assembly code
b) Java independent native code e) NOTA
c) Java Virtual Machine

29. What is the value of num after the following code is executed?

```
int num = 0;  
do {  
    num+=10;  
} while (num < 0);
```

- a) 0 b) 10 c) 20 d) 30 e) NOTA



30. Java has recently been adding many features present in other language, such as `enum`. In the land of Make Pretend, we've also written an extension of the Java programming language, called LispJava, in which all functions and object methods are themselves objects, which inherit from class Procedure. Function definitions are the same as in regular Java, except that before the function's name, we write its class, e.g. `public static void Procedure main(String[] args)`. We can then treat the variable `main` like any other object.

We can use this to pass functions as arguments to other functions. Furthermore, in LispJava, the `LinkedList` implementation has been changed to add a new constructor. The first element is an object to insert at the head of the list, and the second is another `LinkedList`, the elements of which will be inserted sequentially following the first, until the end of the list or a `null` object is reached. For example,

```
LinkedList lst1 = new LinkedList();
lst1.add(new Integer(2));
LinkedList lst2 = new LinkedList(new Integer(1),lst1);
```

At the end of executing these three lines, `lst2` would contain integer objects for 1 and 2, in that order. What is the output of the following program, written in LispJava?

```
import java.util.LinkedList;

public class Foo{

    public static LinkedList Procedure bar(Procedure proc, LinkedList lst){
        if (lst.size() == 0) {
            return null;
        }
        else{
            Integer first = (Integer)lst.removeFirst()
            return new LinkedList(proc(first), bar(proc,lst));
        }
    }

    public static int Procedure baz(Integer num){
        int integerValue = num.intValue();
        return new Integer(integerValue*integerValue);
    }

    public static void Procedure main(String[] argv){
        LinkedList quux = new LinkedList();
        quux.add(new Integer(1));
        quux.add(new Integer(2));
        quux.add(new Integer(3));
        quux.add(new Integer(4));
        LinkedList fred = bar(baz,quux);
        System.out.println(fred);
    }
}
```

- a) Infinite loop error in function `bar` b) 1 4 27 64 c) 2 4 8 16 d) 1 4 9 16 e) NOTA