Choose the best answer for each and record your solution in both the scantron sheet and this exam. If you think there is no answer to any question then answer (e). Good luck!

This sample is meant to show you the style of questions that will appear on the final exam.
The questions on the final will be similar to these.

This sample is NOT meant to indicate the proportion of questions of any type (or topic) that will be on the final exam. The exam covers the entire semester from start to end. There will be four pages on the final exam similar to page 2 of this sample.

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1) Consider method overriding. Which object-oriented programming principle is method overriding NOT a part of?

(a) polymorphism

(b) encapsulation

(c) inheritance

2) What is the correct term for the situation when the compiler cannot make a decision about the speci c behaviour that should be executed by an object and this behaviour is instead determined at runtime?

(a) early binding

(b) mid binding

(c) late binding

3) How many primitive data types does Java have?

(a) 4

(b) 6

(c) 8

4) What is the accessibility of a private attribute?

(a) Any class in the same directory has access to this attribute

(b) Only the class itself has access to this attribute

(c) Only the class and its subclasses have access to this attribute

```
1  public class Top{
2      public int top = 1;
3      public Top(int top){ this.top = top; }
4  }
5
6  public class Middle extends Top{
7      public Middle(int top){
8          super(top);
9          this.top = this.top + top;
10     }
11 }
12
13 public class Bottom extends Middle{
14     public Bottom(){ super(3); }
15     public Bottom(int top){
16         super(top);
17         this.top = top;
18     }
19 }
20
```

These class definitions are used for the next three questions on this page.

5) Which of the following declarations is NOT valid?

(a) Top t = new Bottom()

(b) Top t = new Top()

(c) Top t = new Top(3)

6) Given the following declaration `Top t = new Middle(2);`, what is the value of `t.top`?

(a) 1

(b) 2

(c) 4

7) Given the following declaration `Top t = new Bottom(2);`, what is the value of `t.top`?

(a) 1

(b) 2

(c) 4

8) Consider the following declarations

```
String x = "study";
String y = new String("study");
String z = y;
```

Which of the following evaluates to false?

(a) x.equals(y)

(b) x == y

(c) z == y

9) Consider a Java program called Run that is executed from a command line as follows

```
java Run Cat Dog Eeeeel
```

In the main method, what is the value of args.length?

(a) 3

(b) 4

(c) 5

10) If the string representation of a Queue shows the first element as the leftmost character of the string and the last element as the rightmost element of the string, then what would the string representation of the Queue q be after the following sequence of operations?

```
Queue q = new Queue();
q.enqueue(A);
q.enqueue(B);
q.enqueue(C);
q.enqueue(q.dequeue());
q.enqueue(q.peek();
q.enqueue(D);
```

Note: peek() returns the first element of the queue (but does not remove it), enqueue(e) adds e to the queue, and dequeue() removes an element from the queue.

(a) BCAD

(b) ABCAD

(c) BCABD

```
1  public class Exam{
2      public     static final      int      w = 3;
3      public     static            int      x;
4      private    final             int      z = 1;
5      public                       String course;
6
7      public Exam(String course){
8          this.course = course;
9      }
10
11     public static void main(String[] args){
12         String  s1 = new String("dog");
13         String  s2 = "dog";
14         Integer n1 = 13;
15         double  n2 = 3.2;
16         Exam[]  n3 = new Exam[n1];
17         n3[1] = new Exam("COMP1006/1406");
18         Exam.x = 3;
19     }
20 }
```

For all questions on this page, consider the Exam program above just after line 18 of the main method has executed but the program has not yet ended.

11) Where is the data for the x stored in memory?

(a) the stack

(b) the heap

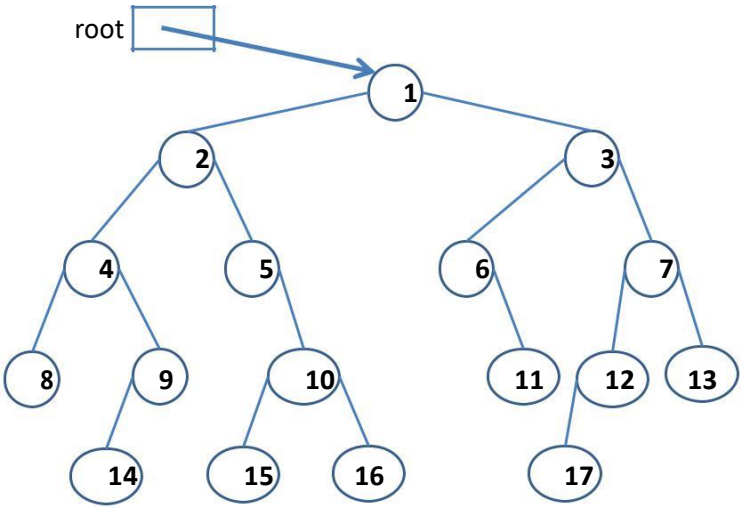
(c) the data segment

12) How many times in total does “dog" appear in memory?

(a) 1

(b) 2

(c) 3



Use this binary tree for all questions on this page. The root node is the node with 1 in it.

13) Which of the following would access the node with value 12?

(a) root.right.right.left

(b) root.left.right.right

(c) root.right.right.left

14) Which of the following is a preorder traversal of the tree?

(a) 8, 4, 14, 9, 2, 5, 15, 10, 16, 1, 6, 11, 3, 17, 12, 7, 13

(b) 1, 2, 4, 8, 9, 14, 5, 10, 15, 16, 3, 6, 11, 7, 12, 17, 13

(c) 8, 14, 9, 4, 15, 16, 10, 5, 2, 11, 6, 17, 12, 13, 7, 3, 1

15) Consider the sequence 8, 14, 9, 4, 15, 16, 10, 5, 2, 11, 6, 17, 12, 13, 7, 3, 1. Which of the following traversals of this tree would produce this sequence?

(a) preorder traversal

(b) inorder traversal

(c) postorder traversal

16) In an inorder traversal of a binary tree when is the root node printed?

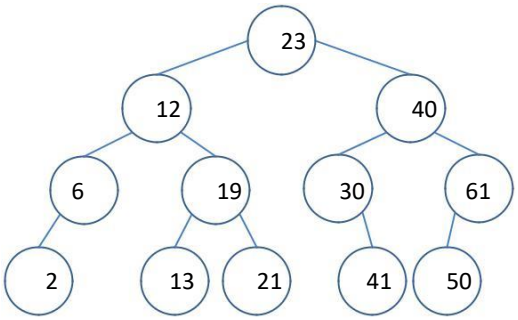
(a) the root is the first value printed

(b) the root is roughly the middle value printed

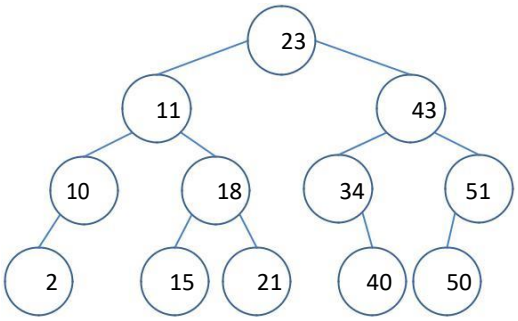
(c) the root is the last value printed

17) Which of the following is a valid binary search tree?

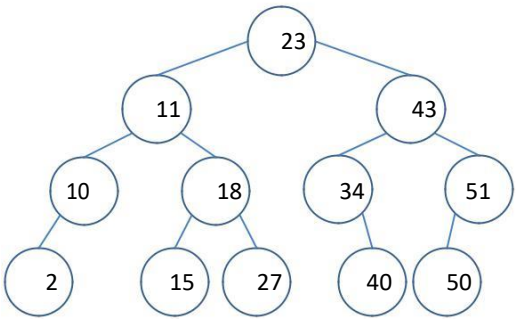
(a)



(b)



(c)



18) What is the worst-case runtime of searching for a value in a binary search tree?

(a) constant O(1)

(b) logarithmic O(logn)

(c) linear O(n)

19) Which sorting algorithm has the most efficient worst-case runtime?

(a) insertion sort

(b) selection sort

(c) mergesort

(d) bubble sort

20) Suppose we are sorting the list [3, 10, 4, 12, 6, 9, 11, 5]. If we use quicksort and the first partition value is 10, which of the following could NOT be the ordering of the list after this first partitioning?

(a) [3, 4, 5, 6, 9, 10, 11, 12]

(b) [9, 6, 5, 4, 3, 10, 12, 11]

(c) [3, 4, 5, 6, 9, 11, 10, 12]