



University of Maryland College Park

Dept of Computer Science

CMSC132 Summer 2015

Midterm I

First Name (PRINT): _____

Last Name (PRINT): _____

University ID: _____

Section/TAName: _____

I pledge on my honor that I have not given or received any unauthorized assistance on this examination.

Your signature: _____

Instructions

- This exam is a closed-book and closed-notes exam.
- Total point value is 100 points.
- The exam is a 80 minutes exam.
- Please use a pencil to complete the exam.
- **WRITE NEATLY.** If we cannot understand your answer, we will not grade it (i.e., 0 credit).

Grader Use Only

#1	True/False	10	
#2	Multiple Choice	20	
#3	Short Answer	45	
#4	Coding Problems	25	
Total	Total	(100)	

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True/False (10 points, 2 points each)

Indicate whether the statement is true or false.

- _____ 1. The inheriting class cannot override the definition of existing methods by providing its own implementation.
- _____ 2. Inserting a node into a single-linked list with n nodes always takes $O(n)$. True or False. Explain
- _____ 3. In Java, the actual method executed is determined by the type of the object and not the type of the reference.
- _____ 4. An interface can have public and private methods.
- _____ 5. An interface can only provide the signature, but cannot provide any code at all.

Multiple Choice(20 points, 2 points each)

Identify the choice that best completes the statement or answers the question.

- _____ 6. The class "Parent" and its inherited class "Child" both implement a method "sayName()", printing "parent" and "child" respectively. Which of the 4 choices below reflects the correct output of the following program:

```
Parent v1 = new Parent();
Child v2 = new Child();
Parent v3 = new Child();
System.out.println(v1.sayName()+" "+ v2.sayName()+" "+ v3.sayName());
```

- | | |
|------------------------|-------------------------|
| a. parent child child | c. parent parent parent |
| b. parent child parent | d. child parent child |
- _____ 7. Assume a linked list with start reference, and, in addition, a reference "current" that points to some Node in the list. How would you refer to the element after "current"?
- | | |
|-----------------|---------------|
| a. current.next | c. start.next |
| b. list.next | d. next |

Name: _____

_____ 8. Consider the following code

```
Stack<Character> s = new Stack<Character>();
String word = "carpets";
int i = 0;
while (i < word.length())
{
    s.push(word.charAt(i)); i++;
}
while(!s.empty()) {
    System.out.print(s.peek());
    s.pop();
}
```

What is written to the screen?

- a. serc
- b. steprac
- c. carpets
- d. ccaarrpeettss

_____ 9. Assume you have an array A of length 1000000 (1e6). In a test you find out that reading the element A[999] takes 1ms (you obviously have a slow computer). How long will it take to read the element A[999999]?

- a. 1/10ms
- b. 1ms
- c. 10ms
- d. 100ms

_____ 10. Which of the following is true?

- a. A single reference can refer to multiple objects
- b. Multiple references can refer to the same, single object
- c. An object can only be referred to by single reference
- d. A reference always refers to a valid object

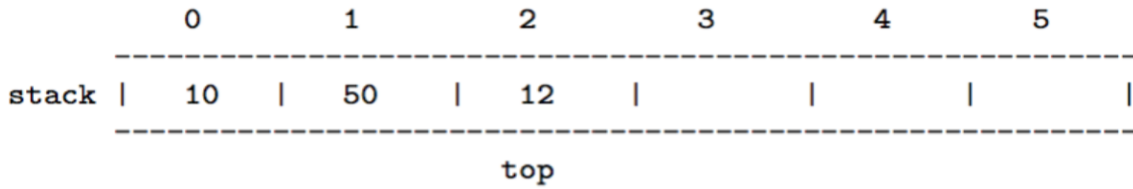
_____ 11. Choose correct equivalent statement of following code.

```
int[][] arr = new int[3][];
for (int i = 0; i < arr.length; i++)
    arr[i] = new int[3];
```

- a. int [][] arr = new int[3][];
- b. int [][3] arr = new int[3][];
- c. int [3][] arr = new int[3][];
- d. int [][] arr = new int[3][3];
- e. None

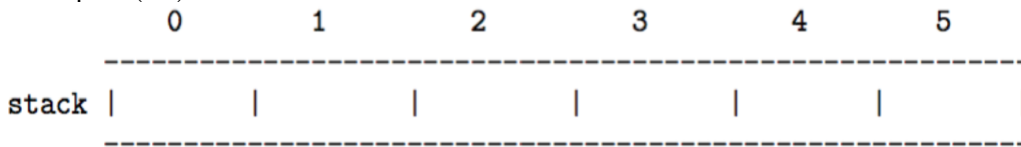
Name: _____

17. Given the following contents of an array implementation of a stack



Show the contents of the stack and the location of top after doing the following

```
stack.pop();
stack.push(7);
stack.push(8);
stack.push(9);
stack.pop();
stack.push(11)
```



18. We want to insert node t immediately after x. Is this code correct? If it is not correct, explain why?

```
x.next = t;
t.next = x.next;
Answer:
```

19. What does the following code fragment do to the queue q, which has string objects?

```
Stack<String> s = new Stack<String>();
while(!q.isEmpty())
    s.push(q.dequeue());
while(!s.isEmpty())
    q.enqueue(s.pop());
```

Answer:

Name: _____

20.

```
public class A {  
    public static int x = 7;  
    public int y = 3;  
}
```

Question: What are the instance variables?

Answer:

21. The following code creates one array and one string object. How many references to those objects exist after the code executes? Is either object eligible for garbage collection?

```
Person[] persons = new Person[10];  
Person manager = new Person("alice");  
persons[0] = manager;  
manager = null;
```

Answer:

22. What is the output of the following program

```
public class Test{  
    public String name;  
    public static int score;  
    public static void main(String[] args){  
        Test t1 = new Test();  
        Test t2 = new Test();  
        t1.name = "Java";  
        t1.score = 90;  
        t2.name = "Python";  
        t2.score = 95;  
        System.out.println(t1.name);  
        System.out.println(t2.name);  
        System.out.println(t1.score);  
        System.out.println(t2.score);  
    }  
}
```

Answer:

Name: _____

23. What does “Comparable” mean in the following class definition.

```
public class SortedBag<E extends Comparable<E>> extends Bag<E>
```

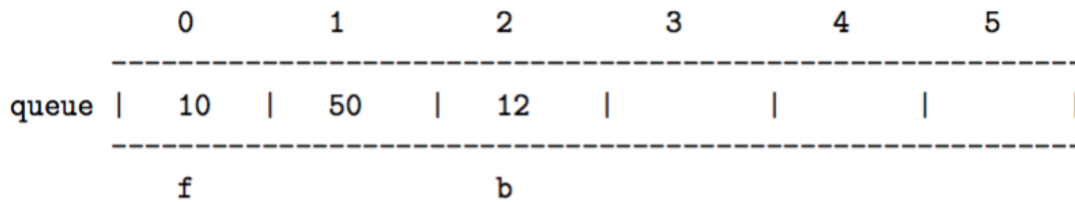
Answer:

```
24. public class A {  
    public static int x = 7;  
    public int y = 3;  
}
```

Question: What are the class variables?

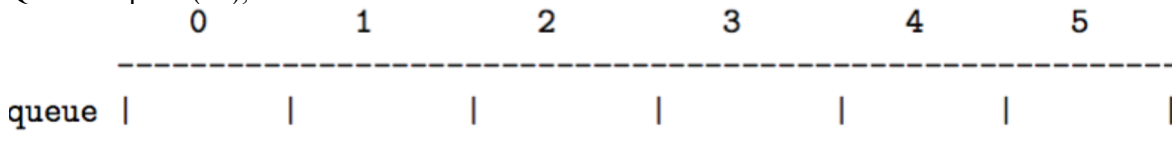
Answer:

25. Given the following contents of a circular array implementation of a queue



Show the contents of the queue and locations of f (front) and b(back) after doing the following:

```
Queue.dequeue();  
Queue.enqueue(7);  
Queue.enqueue(8);  
Queue.enqueue(9);  
Queue.dequeue();  
Queue.enqueue(11);
```



Name: _____

```
26. public class A {  
    public static int x = 7;  
    public int y = 3;  
}
```

Question: What is the output from the following code:

```
A a = new A();  
A b = new A();  
a.y = 5;  
b.y = 6;  
a.x = 1;  
b.x = 2;  
System.out.println("a.y = " + a.y);  
System.out.println("b.y = " + b.y);  
System.out.println("a.x = " + a.x);  
System.out.println("b.x = " + b.x);  
System.out.println("A.x = " + A.x);
```

Answer:

.

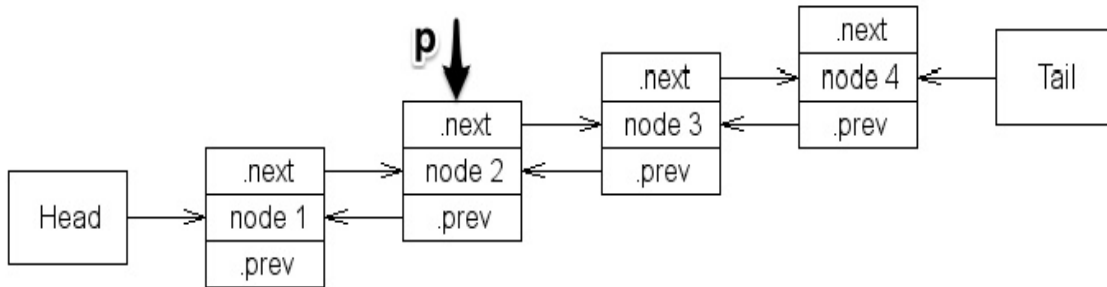
27. Question: What's wrong with the following program?

```
Public class Person{  
    public String name;  
    public int age;  
}  
  
public class A {  
    public static void main(String[] args) {  
        Person person;  
        person.name="alice";  
        person.age = 22;  
        System.out.println("Name: " + person.name);  
    }  
}
```

Answer:

.

Name: _____



28. In the doubly linked list shown above, P reference a node "node2". Write code to delete the node. You are not allowed to start from Head.
Answer:

29. What is the output of following program

```
class A{
    public static void foo(){ System.out.println("A");}
}
class B extends A{
    public static void foo(){ System.out.println("B");}
}
public class C{
    public static void main(String[] args){
        A obj = new B();
        obj.foo();
        A.foo();
        B.foo();
    }
}
```

Answer:

Name: _____

```
30. Abstract class Parent{
    void foo(){
        System.out.println("parent");
    }
}

class Child extends Parent
{
    void foo(int x){
        System.out.println("child");
    }
}
```

Check the following if each statement is valid or invalid. Circle your answer

Parent p1 = new Parent();

Parent p2 = new Child();

Child c = new Child();

p2.foo();

p1.foo(5);

c.foo()

c.foo(10);

Name: _____

Problem

31. (5 points)

```
public class Bag<E> implements Iterable<E>,Cloneable{
    protected E[] items;
    protected int N;//number of items in the bag
    protected int capacity = 10;
    public Bag(){
        items = (E[])new Object[capacity];
    }
}
```

The Bag class uses an array to store its elements. The variable “items” references the array. Write a public method “max” for Bag class. This method returns the maximim item in the bag if the Bag is not empty. It returns “null” if the bags empty.

Answer:

Name: _____

32. (5 points) Write the countOccurrences method with prototype

```
public int countOccurrences(E target)
```

that returns the number of times the given target element appears in this bag. Assume that null data elements are not allowed in the bag.

Answer:

33. (3 points) Assume the Bag size is fixed and the size is provided by the user when the Stack is instantiated. Member variable "CAPACITY" represents the size of the stack, while N represents the number of items in the stack. Write a method "boolean isFull()", which returns true if the stack is full. It returns false otherwise.

Name: _____

34. (7 points) We want to implement this Bag interface. Items in this Bag cannot be removed.

```
public interface Bag<E extends Comparable<E>> extends Iterable<E> {  
    public void enqueue(E item);  
    public E peek();  
    public int size();  
    public E min();  
    public boolean isEmpty();  
}
```

The public method min returns the minimum item in the queue. Describe a constant time ($O(1)$) algorithm for the “min” method and implement it.

Answer:

Name: _____

35. Write a method "Node half(Node head)" that returns the first half of a given linked list. If the list length is odd, first half includes the middle node. "head" references the first node of the list. The length of the list is not given. for example: if the list is head->1->7->13->2->4, you return head->1->7->13.
Node half(Node head)