

Quiz on Induction

Question 0. Everyone gets this correct!

- A) I like college life.
- B) I wish I was on Mars without a space suit.

Question 1

Let $P(n)$ be the statement that

$$1^2+2^2+\dots+n^2 = n(n+1)(2n+1)/6 \text{ for } n > 0.$$

What is the statement $P(1)$?

- A) $1^2+2^2+\dots+n^2 = n(n+1)(2n+1)/6$
- B) $n=1$
- C) $0^2 = 0(0+1)(0+1)/6$
- D) *It doesn't exist.*
- E) $1^2 = 1(1+1)(2+1)/6$

Question 2

Let $P(n)$ be the statement that

$$1^2+2^2+\dots+n^2 = n(n+1)(2n+1)/6 \text{ for } n > 0.$$

What do you use during the inductive proof to go from the first line below to the second line?

$$1^2+2^2+\dots+k^2+(k+1)^2 = (k+1)((k+1)+1)(2(k+1)+1)/6$$

$$k(k+1)(2k+1)/6+(k+1)^2 = (k+1)((k+1)+1)(2(k+1)+1)/6$$

- A) *Algebra*
- B) *Base case*
- C) *Inductive Hypothesis*
- D) *all of the above*

Question 3

Let $P(n)$ be the statement that

$$1^2+2^2+\dots+n^2 = n(n+1)(2n+1)/6 \text{ for } n > 0.$$

If you can't prove the base case, for which values of n can you prove that $P(n)$ is true using mathematical induction?

- A) none
- B) all $n > 0$
- C) just $n = 1$
- D) all $n > k$

Question 4

Let $P(n)$ be the statement that

$$1^2+2^2+\dots+n^2 = n(n+1)(2n+1)/6 \text{ for } n > 0.$$

What do you need to prove the inductive step?

- A) the Inductive Hypothesis
- B) nothing
- C) the base case
- D) the base case and the Inductive Hypothesis

Question 5

Let $P(n)$ be the statement that

$$\sum_{j=1}^n j^3 = n(n+1)(2n+1)(3n^2+3n-1)/30 \text{ for } n > 0.$$

What is the base case (basis step) ?

- A) $\sum_{j=1}^1 j^3 = 1(1+1)(2+1)(3+3-1)/30$
- B) $\sum_{j=1}^n j^3 = 1(1+1)(2+1)(3+3-1)/30$, for $j = 1$ to n
- C) none of the above

Question 6

When proving the Inductive Step, how many times is the Inductive Hypothesis used?

- A) Only once.
- B) More than once.
- C) Sometimes it is not needed.
- D) Once, but only if it is first proved to be true.

Question 7

What was wrong with the inductive proof discussed in class about the color of horses?

- A) *The Inductive Hypothesis was missing.*
- B) *They were unicorns.*
- C) *One of the base cases was missing*
- D) *All of the base cases were missing.*
- E) *The Inductive Step had an error.*

Question 1

A multiple choice test contains 10 questions. There are 4 possible answers for each question. In how many ways can a student answer the questions on the test if the student answers every question?

- A) 10
- B) 4^{10}
- C) 40
- D) 10^4

Question 2

How many bit strings of length n both begin and end with a 1 ?

- A) n
- B) $n^2 - 2$
- C) 2^{n-2}
- D) $2(n-2)$

Question 3

How many strings of 8 English lowercase letters are there that contain at least one vowel, if letters can be repeated? In English, there are 26 letters and 5 vowels.

- A) $26^8 - 21^8$
- B) $21^8 + 5$
- C) $21^7 + 8(5)$
- D) $8!$

Question 4

What is the minimum number of students, each of whom comes from one of the 50 states, who must be enrolled in the university to guarantee that there are at least 11 who come from the same state?

- A) 11
- B) 551
- C) 500
- D) 501

Question 5

Only freshman, sophomores and juniors are registered in our class. What is the minimum number of students in our class to guarantee that there are at least 5 freshman, or 5 sophomores, or 5 juniors?

- A) 13
- B) 15
- C) 12
- D) 6

Question 6

With a group of 4 men and 4 women, how many ways can they be arranged in a row if the men and women alternate ?

- A) 16
- B) $4! 4!$
- C) 2^4
- D) $4! 4! 2$

Question 7

How many 2-permutations of a set of 4 things are there?

- A) $4! / 2!$
- B) $4! / (2! 2!)$
- C) $4! 2!$
- D) 2^4

Question 8

Is $C(10,5) > P(10,5)$?

- A) Yes
- B) No

Quiz 3: Question 1

What should the first line in the following code be?

```
public class Stuff {  
    public abstract int add1(int x);  
}
```

- A) No change. It compiles correctly.
- B) public interface Stuff {
- C) public abstract class Stuff {
- D) public class Object {

Quiz 3: Question 2

```
public class More {  
    public More () {  
        System.out.println("Hi");  
    }  
    public abstract String whatDayIsIt();  
  
    public static void main(String[] args) {  
        More m = new More();  
    }  
}
```

- A) This code compiles and when run the string Hi is printed.
- B) This code compiles but when run no output is produced.
- C) This code does not compile because it contains an abstract method.
- D) This code does not compile because there are no instance variables.

Quiz 3: Question 3

If I already have a class named Student to keep track of most kinds of students, what must I do to efficiently add the capability of handling a new set of students from other planets, without affecting the functioning of my code for handling the usual kind of students?

- A) Make a new class for this new kind of student that extends Student and adds an instance variable for planet.
- B) Call a friend.
- C) Make a new class that is the parent class of Student to hold the new planet information.
- D) Write a completely new program to handle just to handle interplanetary students.

Quiz 3: Question 4

Will `javac A.java` succeed?

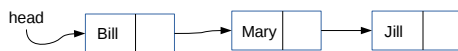
```
// A.java
public class A implements BCD {
    public int B(int a) {
        return a + 2;
    }
    public double C(double x) {
        return x * x;
    }
}
```

```
// BCD.java
public interface BCD {
    public int B(int n);
    public double C(double x);
    public String D();
}
```

- A) Yes
- B) No

Quiz 3: Question 5

Which of the following statements will delete the node containing "Mary" from this linked list?

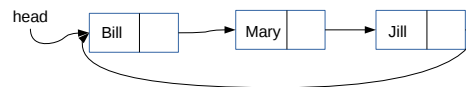


- A) `head.delete("Mary");`
- B) `head.setNext(mary.getNext());`
- C) `head.getNext().setNext(head.getNext());`
- D) `head.setNext(head.getNext().getNext());`

Quiz 3: Question 6

What is printed by this for loop?

```
for (Node p = head; p != null; p = p.getNext())
    System.out.print(p.getItem() + ", ");
```



- A) Bill, Mary, Jill,
- B) Bill, Mary, Jill, Bill, Mary, Jill, ...
- C) Bill, Mary, Jill, Mary, Jill, Mary, Jill, ...
- D) Null pointer exception

Quiz 3: Question 7

If I make a linked list of 1,000 nodes, then set the head reference to null, the memory required by those 1,000 nodes will never be available to my running program.

- A) True
- B) False

Quiz 3: Question 8

Say I have one variable

Node head1;

that points to the first node in a linked list. I can make a second copy of that list by doing

Node head2 = head1;

and if I delete a node from the head2 list, it is not deleted from the head1 list.

- A) True
- B) False

1. Sorting

- Bubble Sort always scans the whole list before performing any swapping.

- A. True
- B. False

2. Sorting

- Selection sort always scans the whole list before doing any swapping.

- A. True
- B. False

2. Sorting

- Insertion sort always scans the whole list before doing any swapping.

- A. True
- B. False

4. Sorting

- Which sort is most similar to how you arrange your hand of cards when you are dealt one card at a time and you want to keep the cards in order?

- A. Bubble sort
- B. Insertion sort
- C. Selection sort

5. Linked Lists

- If variable 'head' is a reference to the first node of a linked list that has two or more elements, what does this statement do?

```
head = head.getNext();
```

- A. Destroys the whole list.
- B. Removes the first element.
- C. Removes the second element.

6. Linked Lists

- If variable 'head' is a reference to the first node of a linked list that has two or more elements, what does this statement do?

```
head = null;
```

- A. Destroys the whole list.
- B. Removes the first element.
- C. Removes the second element.

7. Linked Lists

- After the following statements, which answer is true?

```
Node tmp = head;  
tmp = tmp.getNext().getNext().setNext(null);
```

- A. The list referenced by 'head' is destroyed.
- B. The list now only has one element.
- C. The list now only has two elements.
- D. The list now only has three elements.
- E. The list now only had four elements.

8. Linked Lists

- After this statement, which answer is true?

```
head.setNext(head);
```

- A. The list referenced by 'head' is destroyed.
- B. The list now only has two elements.
- C. The list now appears to have an infinite number of elements, all with the same value.
- D. The code will no longer compile.

9. Interfaces

- Given these definitions:

```
public class A { ... }  
public interface B { ... }  
public class C extends A { ... }  
public interface D extends B { ... }
```

which of the following will compile without error?

- A. public class X extends D { ... }
- B. public class X implements D { ... }
- C. public class X implements A { ... }

10. Interfaces

- Which of these is false?
 - A. An interface cannot contain any method implementations.
 - B. An abstract class can contain instance variables.
 - C. An interface cannot extend an interface.
 - D. An abstract class cannot be instantiated.
 - E. An interface cannot be instantiated.