

Introduction to Programming Questions

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Introduction

Some questions from, or relevant to, the course.

Questions

Prime Mirrors

Write a program to find all the integers that satisfy the following conditions:

- Number x is the n th prime number (e.g. 37 is the 12th prime number). Use the sieve of Eratosthenes algorithm
- The mirror of x is the (mirror of n)th prime number (e.g. 73 is the 21st prime number)

Your program should provide and use at least the following functions/methods:

- `isPrime()` which determines if a passed number is prime or not
- `nthPrime()` which takes a number n , returns the n th prime number. (2 is the 1st prime number, 3 is the 2nd prime number, 5 is the 3rd prime number, etc.)
- `findNextPrime()` which takes a prime number and returns the next greatest prime number
- `mirror()` which returns the mirror number of a passed number (e.g. if given 23456 then it will return 65432)

Matrices

Write a Java class `Matrix` whose instances represent 2D matrices of doubles. Your class should provide the following methods:

- A constructor method which takes a 2D array of doubles and initialises the matrix from this
- An `averageValue` method which returns the average value of the cells in the matrix
- A `normalise` method which returns a new matrix where the sum of the elements in the matrix is 1.0
- An `add` method which takes two matrix objects and returns a new matrix object whose cells are the sum of the corresponding cells in the passed matrix objects

Short Questions

Note that questions may contain errors. If they do contain errors. State the error as your answer

What is the value of result?

```
int m = 4; int n = 6; int p = 7; int result = 10; result += m * n - p;
```

What is the value of result?

```
int result = 11;
if (result < 0)
    result -= 2 * result;
else if (result % 2 == 1)
    result += 1;
else result *= result;
```

What is the value of result?

```
int value = 8; int result = 0;
switch (value) {
    case 1:
        result += value / 2;
        break;
    case 4:
        result -= value;
        break;
    case 8:
        result *= value;
        break;
    default:
        result /= value % 2;
        break;
}
```

What is the value of result?

```
int result = 0;
for (int count = 0; (count < 5); count++)
    result += count;
```

What is the value of result?

```
int result = 0; int x = 23; int y = 3; int z = 0;
while (z < x) {
    z += y;
    result++;
}
```

What is the value of result?

```
int result = 0; int x = 5; int y = 3;
do {
    result = result + y;
} while (x-- > 0);
```

What is the value of result?

```
int function(int number) {
    if (number <= 1)
        return 1;
    else return (number * function(number - 1));
}
```

What is the value of result?

```
final int[] numbers = { 1, 45, 23, 19, 20 };
int result = numbers[1] + numbers[4];
```

Given the following function definitions, what will be stored in myNumbers if we execute: int[] myNumbers = {1, 2, 3, 4, 5}; function(myNumbers);?

```
void function(int[] numbers){
    for (int index = 0; index < numbers.length / 2; index++)
    {
        int temp = numbers[numbers.length - index - 1];
        numbers[numbers.length - index - 1] = numbers[index] = temp;
    }
}
numbers[index];
```

Which one of the following member data declarations (as part of a class definition) could be public?

1. static final int DAYS_IN_THE_YEAR = 365;
2. int mAccountNumber;
3. double mAccountBalance;
4. String mAccountName;
5. static int mLastAccountNumberUsed = 0;

Which of the following pieces of member data should be declared as static (and be initialised in the class definition)?

```
class Time {
    int HOURS_PER_DAY;
    int MINUTES_PER_HOUR;
    int mNumberOfTimeObjectsCreatedToDate;
    int mHours;
    int mMinutes;
}
```

1. HOURS_PER_DAY and MINUTES_PER_HOUR should be static
2. mNumberOfTimeObjectsCreatedToDate, HOURS_PER_DAY and MINUTES_PER_HOUR should be static
3. mHours and mMinutes should be static
4. mHour, mMinutes, HOURS_PER_DAY and MINUTES_PER_HOUR should be static
5. mNumberOfTimeObjectsCreatedToDate, mHours and mMinutes should be static

Which of the following method definitions (as part of the Number class) would be invoked by this code?

```
Number myNumber = new Number(59,23);
Number resultNumber = Number.add(myNumber,40);
```

1. public static Number add(Number num1, Number num2)

2. `public static Number add(Number num1, int num2)`
3. `public void add(Number num)`
4. `public void add(int num)`
5. `public static Number add(int num1, int num2)`

Given the following method definition, what will be stored in result if we execute `int result = fun(1234);`?

```
int fun(int n) {
    if (n <= 9) return n;
    return function(n / 10) + (n % 10);
} // end method fun
```

Given the following code segment. You may assume that list is an array of integers. What will be store in sum?

```
int i = 0; int sum = 0;
while (i <= list.length) {
    sum += list[i];
    i++;
} // end while loop
```

The following program segment is intended to find the index of the last negative integer in the integer array list. Will the segment work as intended? Elaborate

```
int i = list.length;
while (list[--i] >= 0){}
location = i;
```

Consider the following class definition. In some other class, to call the method fun from C class, what you would write?

```
public class C {
    public static void fun() {
        System.out.println("I am fun in C"); } // end method fun
} // end class C
```

What is m.length in the following code segment?

```
Object[][] m = new Object[2][];
m[0] = new Object[3];
m[1] = new Object[4];
```

Consider the following method. Is the method correct? If so, what does the method return?

```
public int fun(int a, int b, int c) {
    if (a < b && a < c) return a;
    if (b < a && b < c) return b;
    if (c < a && c < b) return c;
} // end method fun
```

What is the value of fun(2,3)?

```
public int fun(int a, int b){
    if (b == 1) return a;
    else return a + fun(a, b - 1);
} // end method fun
```

Other Questions

- Write a hello world program
- Implement the fizz buzz game
- Implement a program that checks if a year is a leap year
- Implement a program that compute the factorial of a number
- Write a program that simulates a coin toss
- Write a program to reverse the order of digits of some number
- Write a program which, given two integers, will compute the GCD
- Write a program to compute a particular term in the Fibonacci sequence

Theory Questions

- What is the precedence of the math operators: add, subtract, multiply, divide, modulo?
- What is the syntax for if statements, for loops, while loops, do while loops, exception handling, switch statements, functions, 1D arrays, 2D arrays and ArrayList?
- What are the primitive data types?
- What is the range on an int?
- How many possible doubles are there?
- Show the skeleton code for creating a class and creating an object of that class
- Referring to Java classes, what is an instance variable, method and constructor?
- What is an access modifier? Give examples
- Give an example of an enum
- What is a static subroutine?
- What is a static variable?
- What is inheritance?
- What is polymorphism?
- What is an abstract class?
- What is an abstract method?
- What is an interface? Give example code
- What is a default method?
- Can you construct an object from an interface?