

Old exam practice questions

Question 1A [4]

- Environment Canada will report a humidex value as part of a weather forecast if the temperature (T) is greater than or equal to 30 degrees, if the temperature is greater than or equal to 25 degrees and the humidity (H) is greater than 35%, or the temperature is greater than or equal to 20 degrees and the humidity is greater than or equal to 65%.
- Write a Java Boolean expression that is true if Environment Canada will report a humidex value, and false otherwise.

Question 1B [4]

- Consider the following Java program :

```
MyClass[] obj;  
int index;  
obj = new MyClass[2];  
index = 15;  
while( index > 2 )  
{  
    obj[index % 2] = new MyClass( );  
    index = index / 2;  
}  
  
// Line X
```

- How many instances of **MyClass** are created during the execution of this program? [2]
- How many instances of **MyClass** are still accessible at **Line X**? [2]

Question 1C [4]

```
class Foo
{
    private int x1;
    public static int x2;
    public static Bar x3;

    public Foo(int x4)
    {
        ...
    }
}
```

```
class Bar
{
    public int x5;
    public static int x6()
    {
        ...
    }

    public Foo x7()
    {
        ...
    }
}
```

- Suppose that the following instructions are used in the `main()` method in a class `Test`. Each choice should be considered **independently** - as if it were in its own `main()` method. Circle the letter of the statement which causes a compilation error.

(a) `Foo[] a = new Foo[5];`
`a[4] = new Foo(-1);`

(b) `Foo f = Bar.x7();`

(c) `Foo.x2 = Bar.x6();`

d) `int k = Foo.x3.x5;`

e) `Bar b = new Bar();`

`Foo f = b.x7();`

```
class Football
```

```
{
```

```
    public static void main(String[ ] args)
```

```
    {
```

```
        char[] t = {'G', 'e', 'e', '-', 'G', 'e', 'e'};
```

```
        Rec(t, t.length - 1);
```

```
    }
```

```
public static void Rec(char[] var, int i)
```

```
{
```

```
    if (i < 0)
```

```
    { ; // do nothing
```

```
    }
```

```
    else
```

```
    {
```

```
        if ( (var[i] > 'A') && (var[i] < 'Z') )
```

```
        {
```

```
            System.out.print( (char) (var[i] - 'A' + 'a') );
```

```
        }
```

```
        else
```

```
        {
```

```
            if ( (var[i] > 'a') && (var[i] < 'z') )
```

```
            {
```

```
                System.out.print( (char) (var[i] - 'a' + 'A') );
```

```
            }
```

```
            else
```

```
            { ; // do nothing
```

```
            }
```

```
        }
```

```
        Rec(var, i - 1);
```

```
    }
```

```
}}
```

Question 2

[8]

- Here is a program that uses recursion.
- What is printed by this program?

Question 3 [15]

- The lower right sub-matrix of a matrix is formed by selecting one element position (row and column) and excluding all elements that are to the left or above the selected element. For example, in the matrix M below, if we select $M_{11} = 5$, the matrix S is the lower right sub-matrix.

$$M = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

$$S = \begin{bmatrix} 5 & 6 \\ 8 & 9 \end{bmatrix}$$

- Write a Java method that will take a matrix of integers M , and a row and column index, and returns a new matrix that is the lower right sub-matrix of M formed from that position. The header of the method is as follows:

```
public static int[][] subMatrix( int[][] m, int theRow, int theCol )
```

Question 4 [25]

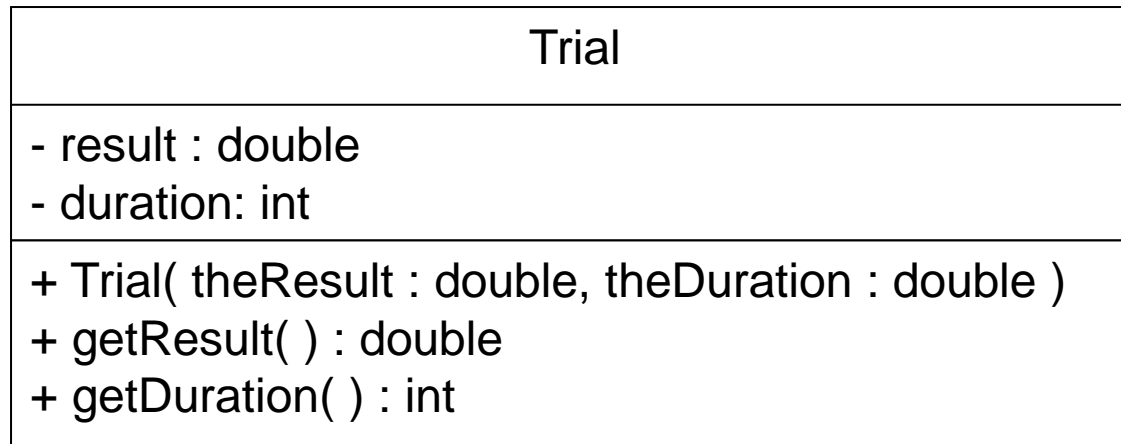
- In this question, you will create a class `Experiment` that represents a record of some sort of scientific experiment. In order to verify that the results of an experiment are repeatable, there is a class `Trial` that contains the results from one run of an experiment. An experiment will then include a number of `Trial` objects.
- The class `Trial` stores a result that was measured during an experiment, and the duration that the experiment took, measured in milliseconds. The class `Trial` has already been implemented. A UML class diagram for the class `Trial` is as follows:

Question 4 [25]

- In this question, you will create a class `Experiment` that represents a record of some sort of scientific experiment.
- In order to verify that the results of an experiment are repeatable, there is a class `Trial` that contains the results from one run of an experiment. An experiment will then include a number of `Trial` objects.

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- The class **Trial** stores a result that was measured during an experiment, and the duration that the experiment took, measured in milliseconds. The class **Trial** has already been implemented. A UML class diagram for the class **Trial** is as follows:



Question 4

- In the rest of this question, you will fill in the methods for `Experiment`. Your `Experiment` class should provide four public methods and/or constructors that would permit the following class `TestExperiment` to execute:

```
class TestExperiment
{
    public static void main (String[] args)
    {
        Experiment anExperiment;
        anExperiment = new Experiment( 2 );
        anExperiment.addTrial( new Trial( 99.1, 10000 ) );
        anExperiment.addTrial( new Trial( 97.1, 11000 ) );
        anExperiment.addTrial( new Trial( 94.1, 12000 ) );
        Experiment.setPredictedResult( 98.6 );
        anExperiment.print();
    }
}
```

- Executing `main()` would result in the following being printed on the screen :

No more trials can be added to the experiment.

Trial 0: Result 99.1, duration 10000 (within 0.5 of prediction)

Trial 1: Result 97.1, duration 11000 (within 1.5 of prediction)

Question 4

```
class Experiment
```

```
{
```

```
    // FIELD DECLARATION(S): (4 marks)
```

```
    // CONSTRUCTOR: (5 marks)
```

```
    // Takes one integer parameter representing the maximum
```

```
    // number of trials that can be put into the experiment
```

Question 4

```
// METHOD setPredictedResult: (4 marks)
// Method parameters: a double that is the predicted result
// of the experiment.
// RESULT: none
```

Question 4

```
// MODIFIER METHOD addTrial: (6 marks)
// Method parameters: a Trial object that should be added to the Experiment.
// Results: will print a message if the experiment has no room to store
// additional trials (see sample output for message format)
// Modified: the Experiment object
```

Question 4

```
// METHOD print: (6 marks)
// Method parameters: (none)
// Returns: (none)
// This method prints the result and duration of each trial, along with
// the absolute value of the difference from the predicted result.
// See the TestExperiment sample output for exact format.
```

Question 5 [10]

Binary search

Suppose that you have an array of integers that is already known to be sorted in ascending order, and to contain no duplicate values. A binary search on such an array is done by locating the middle element of an array and comparing the search value with that element. If we have not found the value for which we are searching, we can choose the appropriate sub-interval (either the left or the right side) to restrict the search.

Write a recursive method that will perform a binary search on an array `a` for the value `findMe` between positions `startIndex` and `endIndex`. You can assume that both positions are less than the length of the array. The method should return `true` if the value is contained in the array, and `false` otherwise.