ITKP102 Programming 1 (6 ECTS)

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Answer each of the four questions. **Please write each of your answers on a separate answer sheet.** In the programming tasks, follow the C# coding conventions. You are allowed to have one A4 size cheat sheet.

If this is an Autumn 2017 retake for you, please put a note “Syksyn 2017 uusinta” on top of *each* answer paper.

Suomeksi

Saat tentinvalvojalta halutessasi tenttikysymykset suomeksi.

JYVÄSKYLÄN YLIOPISTO

Task 1 (6 p.)

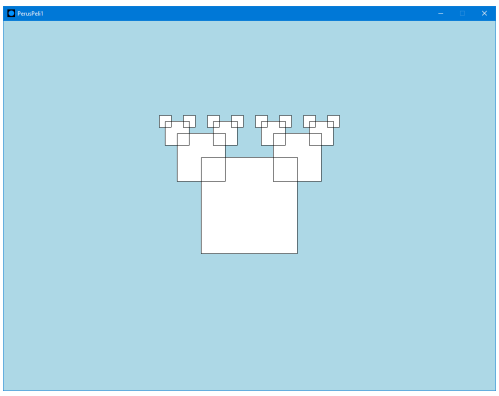
Place the following program components in the correct order in a C# program, and give an example of each type of statement. Use each component exactly once. In the answer sheet, in each line write a number (1–11) and your example. The examples must make up a working program that compiles. Indentations, naming, and spelling will be considered in the assessment. Documentation comments are *not* required.

1. heading for Main method.
2. `using` statement for system library.
3. variable declaration for `x`, which will store a whole number.
4. output statement showing value of `x`.
5. heading for class.
6. statement assigning a random number from 1 to 6 to `x`.
7. statement declaring and initializing a `Random` object.
8. start bracket for class.
9. end bracket for class.
10. start bracket for Main method.
11. end bracket for Main method.

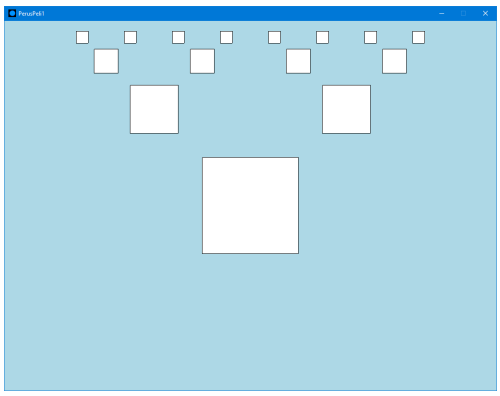
Task 2 (6 p.)

(a) We have a recursive function `Squares` (see the source code in next page), that is called from `Begin`. Which of the figures a–d the program makes? We'll assume, that Jypeli library is used, and that the class, `Main` etc. are well defined and the program compiles. (3 p.)

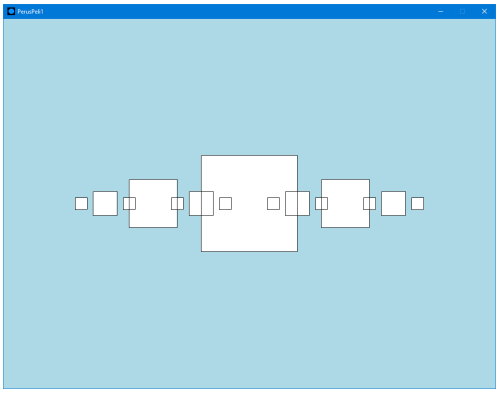
```
public override void Begin()
{
  Squares(0, 0, 200);
}

public void Squares(double x, double y, double w)
{
  if (w < 20) return;

  GameObject square = new GameObject(w, w);
  square.Position = new Vector(x, y);
  Add(square);

  Squares(x - w, y + w, w / 2);
  Squares(x + w, y - w, w / 2);
}
```



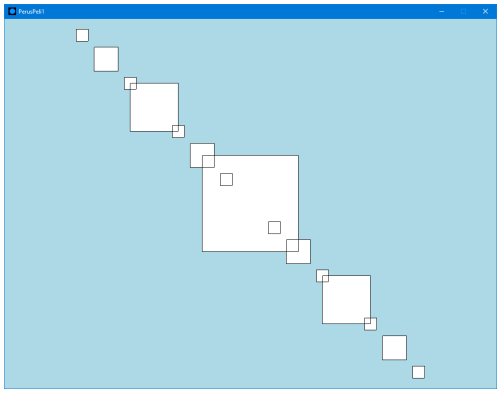
(a)



(b)



(c)



(d)

(b) Make a function `Factorial`, that calculates the factorial of n. You can use iteration or recursion. Assume, that $n > 0$, and that

```
Factorial(0) = 1
Factorial(n) = n * Factorial(n-1)
```

Documentation comments must be written with XML tags and using course conventions. (3 p.)

Task 3 (6 p.)

In each item (1–6) choose exactly one of the options (a–d). Please note that you do not need to nor are you rewarded for presenting reasoning—simply write your selection on the answer sheet.

1. Assume that we have a function with a declaration `public static bool Anagrammi(string merkkijono)`. What of the following is correct?

   (a) Calling the function with an empty string (i.e. `string` object, that contains zero characters) causes a runtime error.

   (b) If the `merkkijono` variable contains the string `saippuakauppias`, the function will return a string `saippuakauppias`.

   (c) The function can be called without assigning the return value to a `bool` variable in the scope where the function was called.

   (d) Function can return values `0` or `1`.

2. Which of the following claims is correct for C#?

   (a) The operator `=` is used in `if` statement's condition to compare two boolean values.

   (b) Operators < and > can change the value of a variable.

   (c) A variable can be declared before assigning a value to it.

   (d) Assignment operator must always be enclosed in brackets or parentheses.

3. Which of the following claims is correct for C#?

   (a) Array's length can be changed after its creation.

   (b) Array's elements are located in indices `0...Length`.

(c) Array can have a maximum of two dimensions.

(d) The length of the array `a` (`a.Length`) can be inferred based on the following statement:

```
int[] a = new int[] { };
```

4. The general format of a `for` structure is
```
for (initialization ; condition ; iteration) { statements }
```
Which of the following claims is correct for C#?

(a) Condition can be any expression with an integer value.

(b) It is *not* possible to do infinite loops with `for`.

(c) Any of the parts (initialization, condition, iteration, statements) can be left blank.

(d) In initialization, at least one `int` variable must be declared.

5. We have the following code:
```
string word = "1";
int count = CountChars(word + 23);
```
Further, we assume, that `CountChars` exists and it has the following declaration:
```
public static int CountChars(string s)
```
Which of the following claims is correct?

(a) Program will not compile.

(b) `CountChars` function is given one argument, `"123"`.

(c) `CountChars` function is given one argument, `"24"`.

(d) `CountChars` function is given one two different arguments, `"1"` and `"23"`.

6. Which of the following claims is correct for C#?

(a) A non-`void` function (the type of the function's return value is not `void`) has to have at least one `return` statement.

(b) Consider the assignment `int d = F(1.1);`. The type of the `F`'s return value *can* be `double`.

(c) A `return` statement in a `void` function produces a compile error.

(d) A `return` statement can be replaced with a `break` statement where necessary.

Task 4 (6 p.)

Write a function that computes the amount of money in a bank account after N years using the following formula:

$$P * (1 + R)^N$$

where P represents the initial deposit, R is the percent interest rate compounded annually and N is the number of (whole) years of compounding. You are not allowed to use ready-made functions, such as `Math.Pow` for exponentiation.

Example: $P = 100$, $R = 0.03$ (that is, 3%) and $N = 5$ the amount would be c. 115.93. Corresponding use of the function would be:

```
double value = Deposit(100.0, 0.03, 5);
Console.WriteLine(value) // 115.9274...
```

Write documentation comments using XML tags and course conventions.