

Informatics C/C++

Items 1-10 are multiple-choice with a single correct answer, and each is scored with 0.9 points (1 point awarded from start for this section).

Items 11 and 12 are scored with 4.5 points each (1 point awarded from start for this section)

Final score is calculated as: $N = 0.6N_1 + 0.4N_2$, unde

N_1 = score for the first section (items 1-10) + 1 point from start,

N_2 = score for the second section (items 11-12) + 1 point from start .

Working time – two hours.

1. All strings with lengths of maximum 4 distinct characters in the set {s,u,p,r,a,c,o,n,d,u,c,t,o,r} are generated by using the backtracking method, in lexicographic order. First 5 generated strings are: a, ac, acd, acdn, acdo (in that order). Immediately after the string con the following one is generated:

- a. cao b. cand c. cano d. cap

2. Consider the function $f()$, herewith defined.

The return value of the call $f(52, 3)$ is:

- a. 3 b. 52 c. 48 d. 12

```
int f(int x,int y)
{
    if(x < 4*y) return y;
    return f(x,4*y);
}
```

3. The real variable x contains the geometric average of the variables x, y after executing the following C/C++ statement:

- a. $x = \text{sqrt}(x*y)$; b. $x = (x+y)/2$; c. $x = 1/x + 1/y$; d. $x = x*y$;

4. The C/C++ statement $(-10 \leq x) \ \&\& \ !(x > -5) \ || \ (x \geq 5) \ \&\& \ !(x > 10)$ evaluates to 1 if and only if the real variable x is in the set:

- a. $(-\infty, -10] \cup (10, \infty)$ b. $[-10, -5] \cup [5, 10]$ c. $[-5, 5]$ d. $[-10, 5] \cup [10, \infty]$

5. Consider the function $f()$, herewith defined (The expression $x\%y$ gives the remainder of the ratio of the natural number x to the natural non-zero number y).

The values displayed after executing the statement:

```
cout << f(21) << ' ' << f(52) << "\n\n";
```

are:

- a. 0 0 b. 9 2 c. 7 0 d. 21 0

```
int f(unsigned int x)
{
    if(x%3 == 0)
        return x;
    return f(x/3);
}
```

6. Consider the function $fs()$, herewith defined.

The return value of the call $fs(2468, 3579)$;

is:

- a. 1111 b. 2468 c. 3579 d. 0

```
int fs(int n, int m){
    int tmp,d,s;
    if(n<m)
    { tmp=n; n=m; m=tmp; }
    d=1;
    while(m>0)
    {
        s=m%10; m=m/10; n=n-d*s; d=d*10;
    }
    cout << n << "\n\n";
}
```

7. Consider the oriented graph with 7 vertices, numbered from 1 to 7, represented by the adjacency lists indicated below. Two paths are distinct if different by at least one segment. The number of elementary distinct paths from vertex 2 to vertex 3 is:

1: 4, 7
2: 1, 5, 6
3: 2
4: empty list
5: 3
6: 4, 7
7: 4

- a. 0 b. 2 c. 1 d. 3

8. Leafs of the tree structure with 8 nodes, numbered from 1 to 8, represented by the parent vector (0,1,4,7,1,8,1,3) are:

- a. 2,5,7,6 b. 2,5,6 c. 2,5,7 d. 4,3,6,8

9. What is the string displayed after executing the C/C++ code sequence indicated herewith?

```
int k='C'-'c',i;
char txt[100];
strcpy(txt,"plasmon");
for(i=0;i<strlen(txt);i++)
    if(strchr("aeiou",txt[i])==NULL)
        txt[i]=txt[i]+ k;
cout << txt << "\n\n";
```

- a. PLASMON b. p1Asm0n c. A0 d. PLaSMoN

10. Consider the recursive function DIV, herewith defined. To return the greatest common factor of natural numbers 123 and 321, a possible call of that function could be:

```
int DIV (int x, int y, int z)
{
    if(x%z==0 && y%z==0) return z;
    else return DIV(x,y,z-1);
}
```

- a. DIV(1,123,321) b. DIV(123,321,123) c. DIV(321,321,123) d. DIV(123,321,1)

11. Write a C or C++ program to count the lines in a text file, indicated as a parameter in the command line.

12. Write a C or C++ program to read `double` values from a binary file, indicated as a parameter in the command line. The binary file contains 200 `double` real numbers and your program must read and store in an array the last 100 values.