C Programming Language: Beginning exam 2014-9-16 (120 minutes)

1. Which statement about C language is true ?
   (A) C is a typical object-oriented programming language
   (B) You can compare two variables with = operator.
   (C) The following code:
   ```
   char *a = "Hello " + "World";
   printf("%s", a);
   ```
   will print "Hello World" on the screen.
   (D) The following code:
   ```
   int *a;
   printf("%d\n", a);
   ```
   is executable.

2. Please correct a compilation error and write down the result of program.
   ```
   #include <stdio.h>
   int main()
   {
       const int x = 3;
       printf("x = %d\n", ++x);
       printf("x = %d\n", x += 2);
       printf("x = %d\n", x--);
       return 0;
   }
   ```

3. There are two integers, from 0 to 10.
   Please write a complete program to calculate a+b and print the answer on screen.

4. There are two unsigned integers, from 0 to 4294967295.
   Please write a complete program to check whether a+b might overflow.
   Print "Yes" if it will overflow; otherwise, print "No".
   (You can assume that all integers are stored in unsigned integer.)

5. There are some data like the below:
   ```
   1/4 + 5/6
   2/3 + 1/4
   ```
   Please write a complete program to calculate it and output simple fraction.

   For example, the output of the above-mentioned will be
   ```
   1/4 + 5/6 = 13/12
   2/7 + 1/5 = 17/35
   ```

6. There are some data like the below:

   140an-116apple:5566a-8080day-23keeps:101the-9527doctor-88away

   2266practice-3141592653589793238462643makes:0800092000perfect

   (The length of string will be less than 1024.)

   Now, I want you to write a program to remove all the numbers before the words and replace "-" or ":" with space.

   For example, the output of the above-mentioned will be

   an apple a day keeps the doctor away

   practice makes perfect

7. There are some data like the below:

   2

   1 1 1 1

   5 9 6 5

   First line indicates the number of cases.

   The following line represent a.b.c.d in the below structure (where 0 <= a,b,c,d <= 200):

```
struct _info {
    char a;
    int b;
    long c;
    short d;
 };
```

   Now, I want to use unsigned integer to save these data in the memory by the below format.

1 Byte	1 Byte	1 Byte	1 Byte
a	b	c	d

   And, I want to sort them in descending order.

   For example, the output of above-mentioned will be

   84477445

   16843009

   Hint:

   The first line in sample input is "1 1 1 1".

   Follow the above-mentioned format, the bits of unsigned integer will be

   0000 0001 0000 0001 0000 0001 0000 0001, representing 16843009.

8. There are some data like the below:

600 4

12345678901234567890123456789 300

These integers represent a and b (where a <= 10^50 and 1 <= b <= 65535).

Please write a complete program to test if a can be divided by b.

Print "Yes" if a can be divided by b; otherwise, print "No".

9. There are some data like the below:

   1 0 0 0 -1 2

   1 -1 1 -1 -1 1

   These integers represent p, q, r, s, t and u (where 0 <= p,r <= 20 and -20 <= q,s,t <= 0).

   Please write a complete program to solve the equation

   p*e^(-x) + q*sin(x) + r*cos(x) + s*tan(x) + t*x^2 + u = 0 (where 0 <= x <= 1).

   For example, the output of above-mentioned will be

   No solution

   0.7554

   Hint: You must use an efficient algorithm.

10. Code Project: XOR Decoder

    There is a one-line text file encrypted with XOR Encryption Method, named "input.txt".

    The key used in encryption process is "CSIE".

    Please design a C program to let user input the key. Then read the file, decrypt text, and print on the screen.

    (The length of key will be less than 1024.)

    XOR Operations:

    a XOR C ⇒ 34

    a XOR CSIE ⇒ a XOR C → XOR S → XOR I → XOR E ⇒ 125

    34 XOR C ⇒ a

    125 XOR CSIE ⇒ 125 XOR C → XOR S → XOR I → XOR E ⇒ a

    Example:

    abc → (Encrypt with CSIE) → 125 126 127

    125 126 127 → (Decrypt with CSIE) → abc