Exercise Problems - 6

Nested loops, Different types of loops

1. An outline of a program to print the first n prime numbers is given below. Complete the program.

```
#include <stdio.h>
int main()
{
  int counter=1, num=2, n, i;
  printf("enter the number of primes required\n");
  scanf("%d", &n);
  printf("\nfirst %d primes are given below\n",n);
  while(counter <= n)
  {
      i=___________;
      while(i <= num/2)
      {
          if (num%i == 0) //we found a non-trivial divisor of n
          {
             _________________
          }
          i=i+1;
      }
      if (i > ___________)
      {
        printf("%d \n", num);
        counter = _____________________;
      }

      num = ________________________;
  }
  return(0);
}
```

2. This question is to rewrite Question No.1 of Exercise sheet 5, using a `for` loop instead of a `while` loop. The following is an outline of a program to take a number `n` as input from the user and print the list of all numbers which are perfect squares less than `n`. Complete the missing parts.

```
#include<stdio.h>
int main()
{
    int n, i, t;
    printf("Give n \n");
    scanf("%d",__________);
    t=1;
    for(i=2; ________; _________)
    {
      printf("%d \n",t);
      t=i*i;
    }

   return 0;

}
```

3. This question is to rewrite the solution for Question No.2 of Exercise sheet 5, using a `do-while` loop instead of a `while` loop. Write a program that repeatedly asks the user to enter numbers until she/he gives 0 or a negative number as input. Once the user gives 0 or a negative number, the maximum of all numbers entered till then should be printed as output to the user. If the first number entered is 0 or a negative number, the output should be 0. Do not use `break` instruction in your program.

4. A *zero triangle* of height 5 looks like the following:

```
0
0 0
0 0 0
0 0 0 0
0 0 0 0 0
```

   In general, a zero triangle of height h is an extension of the above format, with h lines instead of 5, such that for each $1 \leq i \leq h$, there will be i zeros are printed in line i. Write a program to take h as input from the user and prints a zero triangle of height h as output. (Hint: use nested for loops.)

5. Let $S_n = \{(a, b) \mid a, b \text{ are natural numbers, } a \leq b, a + b \leq n\}$. Write a program that takes a number n as input from the user and prints the elements of the set S_n as output. For example, if $n = 5$, the output should be $(1, 1)$ $(1, 2)$ $(1, 3)$ $(1, 4)$ $(2, 2)$ $(2, 3)$.

6. This question is about enumerating ordered pairs of positive integers in a particular sequence. Let $X_n = \{(a, b) \mid a, b \text{ are natural numbers, } a+b = n\}$. In our enumeration, ordered pairs in X_2 are listed first. This is followed by listing ordered pairs in X_3

in the increasing order of their first coordinates. After that, ordered pairs in X_4 are listed in the increasing order of their first coordinates and so on. Write a program to take a number k as input from the user and print the first k terms of this sequence. For example, if $k = 12$, the output should be $(1, 1)$ $(1, 2)$ $(2, 1)$ $(1, 3)$ $(2, 2)$ $(3, 1)$ $(1, 4)$ $(2, 3)$ $(3, 2)$ $(4, 1)$ $(1, 5)$ $(2, 4)$.