

**Dhaka University of Engineering & Technology, Gazipur**  
**Department of Computer Science and Engineering**  
**CSE 1122 (Structured Programming Language Sessional)**

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These Programs illustrate on Advanced Conditional Statements and Loop structures in C Language:

1. An integer is a palindrome if the reverse of that number is equal to the original number. Write a program to find out that a given input is palindrome or not.

Sample input: 212

Output: palindrome

Sample input: 110

Output: not palindrome

2. The Fibonacci sequence is defined by the recurrence relation:

$F_n = F_{n-1} + F_{n-2}$ , where  $F_1 = 1$  and  $F_2 = 1$ .

Hence the first 10 terms will be:

$F_1 = 1$

$F_2 = 1$

$F_3 = 2$

$F_4 = 3$

$F_5 = 5$

$F_6 = 8$

$F_7 = 13$

$F_8 = 21$

$F_9 = 34$

$F_{10} = 55$

Now, write a program which will take input  $\langle n \rangle$  and find the Fibonacci sequence up to  $n^{\text{th}}$  term.

3. The following iterative sequence is defined for the set of positive integers:

$n \rightarrow n/2$  ( $n$  is even)

$n \rightarrow 3n + 1$  ( $n$  is odd)

Using the rule above and starting with 13, we generate the following sequence:

13  $\rightarrow$  40  $\rightarrow$  20  $\rightarrow$  10  $\rightarrow$  5  $\rightarrow$  16  $\rightarrow$  8  $\rightarrow$  4  $\rightarrow$  2  $\rightarrow$  1 (Here, 13 has a sequence of 10 to converge to 1)

Write a computer program that will take one input  $\langle n \rangle$  and determine the number  $\leq n$ , which has the longest sequence to converge to 1.

Sample input: 5

Output: maximum 8 sequences for number 3

4. Write a program to display a pattern like below. Your program should take the height of a pattern from the keyboard. For example, a pattern of height 5 is shown below.

AA

BBAA

AABBAA

BBAABBAA

AABBAABBAA

5. Write a program that will take one input  $\langle n \rangle$  and output the prime factorization of  $\langle n \rangle$ .

Example:

input: 20

output: 2 X 2 X 5

input: 78

output: 2 x 3 x 13

input: 330

output:  $2 \times 3 \times 5 \times 11$

6. Write a function *DisplayNumberSystem* that prints a table of the binary, octal, hexadecimal equivalents of the decimal numbers in the range 0 through 16 (Table 01).

Decimal Number	Binary Number	Octal Number	Hexadecimal Number
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F
16	10000	20	10

Table 01: Decimal, binary, octal and hexadecimal equivalents

7. Amicable numbers are two different numbers so related that the sum of the proper divisors of each is equal to the other number. The first few amicable pairs are: (220, 284), (1184, 1210), (2620, 2924), (5020, 5564), (6232, 6368). Here, sum of 220's proper divisors (1,2,4,5,10,11,20,22,44, 55,110) is 284 and sum of 284's proper divisors (1,2,4,71,142) is 220.

Write a program that will determine whether two numbers are amicable.  
Sample input: 220 284  
output: amicable

8. Write a program to display a Diamond pattern like below. Your program should take the height of a pattern from the keyboard. For example, a pattern of height 5 is shown below.

```
1
121
12321
1234321
123454321
1234321
12321
121
1
```