# Lab03

**Please do not use any math function in this lab, ex: pow().**

## 1. Homework Problem I

**Part 1.** Write programs to accumulate and print the following:

( where n reads from the keyboard)

(a). $20 + 22 + 24 + \ldots + 2n$

(b). $1 + \frac{1}{3} + \frac{1}{5} + \ldots + \frac{1}{101}$

(c). $1 + \frac{1}{2!} + \frac{1}{3!} + \ldots + \frac{1}{n!}$

(d). $1 - 2 + 3 - 4 + 5 + \ldots + (-1)^{n+1} n$

(e). $1 + (1+2) + (1+2+3) + (1+2+3+4) + \ldots + (1+2+3+\ldots+n)$

**Part 2**.

A common highway patrol speed-detection radar unit emits a beam of microwaves at a frequency $f_0$. The beam is reflected off an approaching car, and the reflected beam is picked up and analyzed by the radar unit. The frequency of the reflected beam is shifted slightly from $f_0$ to $f_1$ due to the motion of the car. The relationship between the speed of the car, *v*, in miles per hour and the two microwave frequencies is

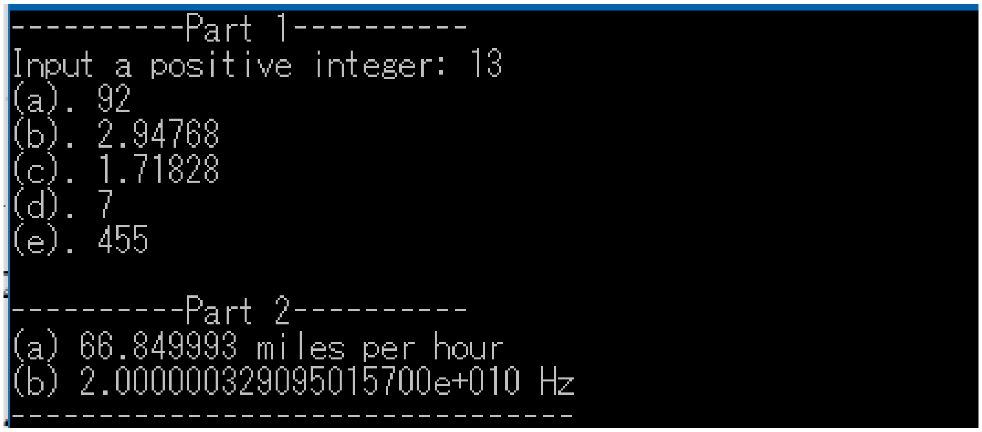
$$v = (6.685 \times 10^8) \times \frac{f_1 - f_0}{f_1 + f_0}$$

Where the emitted waves have a frequency of $f_0 = 2 \times 10^{10}\ \mathrm{sec}^{-1}$.

(a).Using this formula, write a program to calculate and display the speed corresponding to a received frequency of $2.0000004 \times 10^{10}\ \mathrm{sec}^{-1}$

(b). Modify the above program to determine the frequency that will be returned by a car traveling at 55 miles per hour. **(Use scientific notation to the 18th decimal place)**

**Sample Output:**



```
----------Part 1----------
Input a positive integer: 13
(a). 92
(b). 2.94768
(c). 1.71828
(d). 7
(e). 455

----------Part 2----------
(a) 66.849993 miles per hour
(b) 2.000000329095015700e+010 Hz
--------------------------------
```

## 2. Homework Problem II

**Part 1.** A polynomial $a_n x^n + a_{n-1} x^{n-1} + \ldots + a_0$ can be evaluated by:

(Method A). In a straightforward way by performing the indicated operations.

(Method B). Factor the polynomial according to the following formula, known as HORNER'S Rule:

$$\mathbf{(\ldots((a_n x + a_{n-1})\, x + a_{n-2})\, x + \ldots + a_1) + a_0}$$

Please use at most 5 variables and don't use pow() function in each method.

And use only one loop in method B (nested loop is not allowed) .

Let user input the **number n**, the **value of x**, and the **coefficient of x**:

$a^n$, $a^{n-1}$, $a^{n-2}$, ..., $a^0$ from keyboard. And output the answer of the equation.

(1). Write a program to evaluate polynomials by these two different methods.

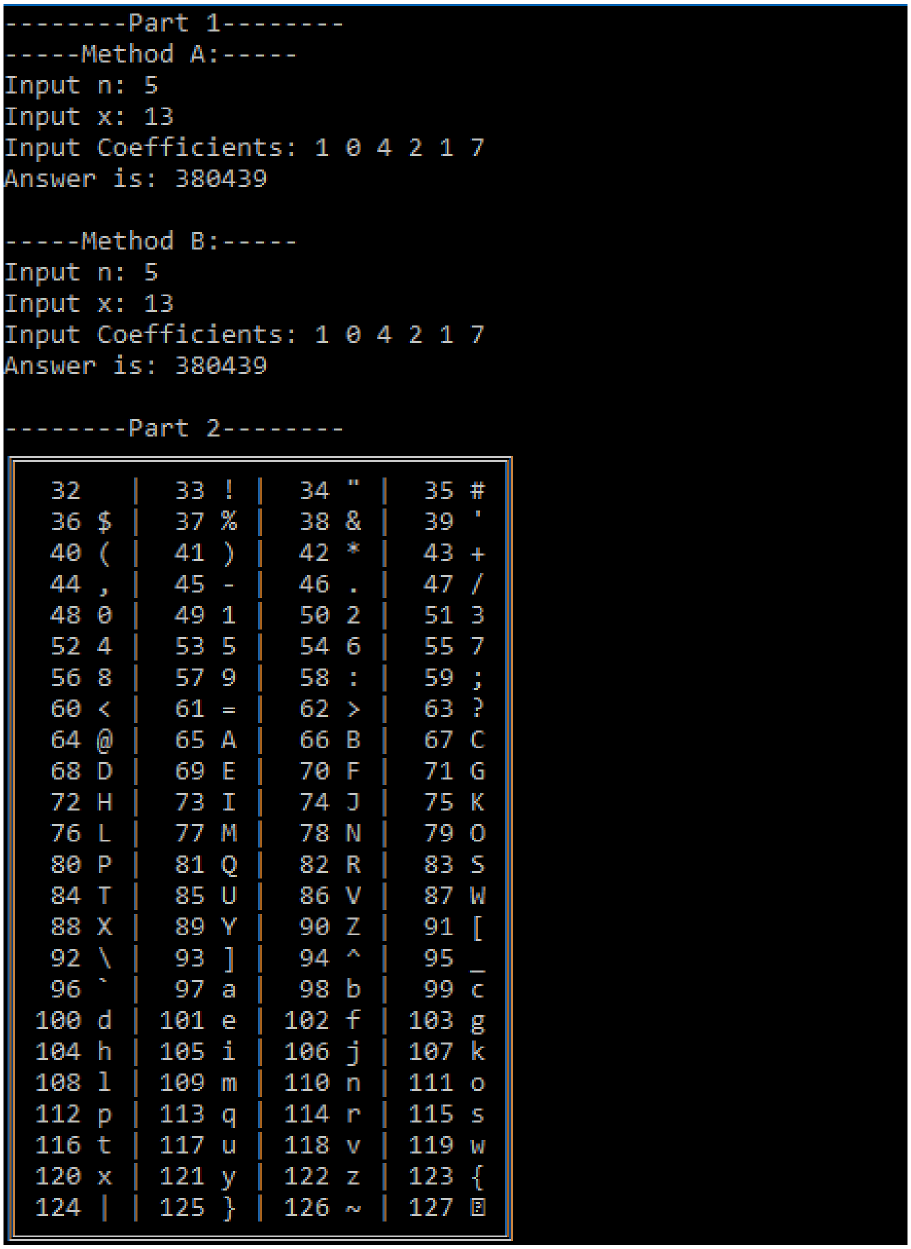
(2). Please compare these two methods and tell TAs that how many multiplications and summation are used in each method.

**Part 2**. Write a program that displays the ASCII chart from 0x20 to 0x7F. Display numeric codes as well as characters so that there are four columns and as many rows as it takes. For an extra bonus, display the chart so that its outside borders are made up of double line ASCII characters, and separate each column with a single vertical ASCII character.

**Reference Code:**

```c
#include <stdio.h>
#include <stdlib.h>  //int system (const char* command);
int main(){
	system("chcp 437 && cls");  //show extended ASCII

	//write your code here

	return 0;
}
```

## Sample Output:



```
--------Part 1--------
-----Method A:-----
Input n: 5
Input x: 13
Input Coefficients: 1 0 4 2 1 7
Answer is: 380439

-----Method B:-----
Input n: 5
Input x: 13
Input Coefficients: 1 0 4 2 1 7
Answer is: 380439

--------Part 2--------

   32   |  33 ! |  34 " |  35 #
   36 $ |  37 % |  38 & |  39 '
   40 ( |  41 ) |  42 * |  43 +
   44 , |  45 - |  46 . |  47 /
   48 0 |  49 1 |  50 2 |  51 3
   52 4 |  53 5 |  54 6 |  55 7
   56 8 |  57 9 |  58 : |  59 ;
   60 < |  61 = |  62 > |  63 ?
   64 @ |  65 A |  66 B |  67 C
   68 D |  69 E |  70 F |  71 G
   72 H |  73 I |  74 J |  75 K
   76 L |  77 M |  78 N |  79 O
   80 P |  81 Q |  82 R |  83 S
   84 T |  85 U |  86 V |  87 W
   88 X |  89 Y |  90 Z |  91 [
   92 \ |  93 ] |  94 ^ |  95 _
   96 ` |  97 a |  98 b |  99 c
  100 d | 101 e | 102 f | 103 g
  104 h | 105 i | 106 j | 107 k
  108 l | 109 m | 110 n | 111 o
  112 p | 113 q | 114 r | 115 s
  116 t | 117 u | 118 v | 119 w
  120 x | 121 y | 122 z | 123 {
  124 | | 125 } | 126 ~ | 127 □
```

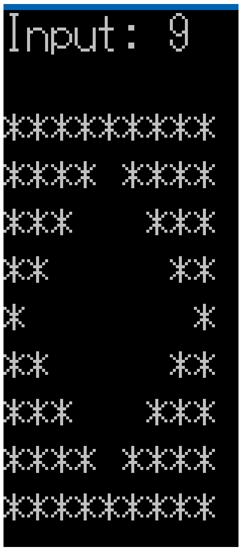
### 3. Hollow Diamond

Write a program which prompt the user to input a single odd integer “height” and displays a “hollow diamond” of this height made up of “*” characters on the screen.

Please use a two-level nested loop.

Hint: use ternary operator

**Sample Output:**



```
Input: 9

*********
**** ****
***   ***
**     **
*       *
**     **
***   ***
**** ****
*********
```

### 4. Extended ASCII Table

Finish following code to print out an ASCII table as shown in the sample output. Only print from **0x20 to 0xFF** to skip unprintable characters.

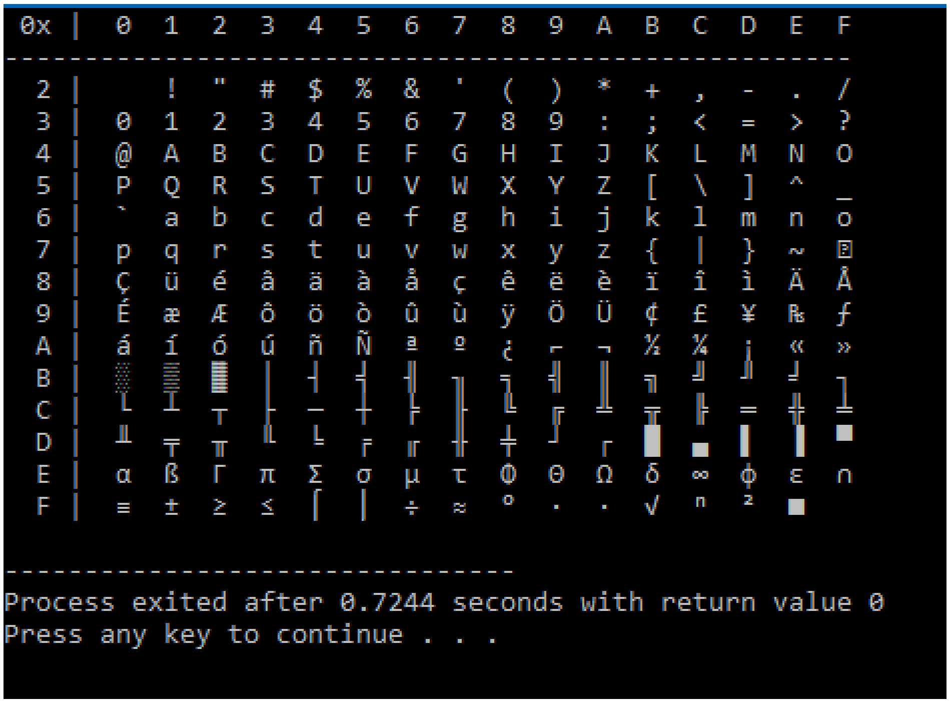
Please use only one loop (nested loop is not allowed).

Hint: use ternary operator

```c
#include <stdio.h>
#include <stdlib.h>  //for system()

int main(){
	//change code page to 437 and clear screen
	system("chcp 437 && cls");

	//your code here

	return 0;
}
```

Hint: If Greek characters are fullwidth, try to change console’s font.

**Sample Output:**



```
 0x |  0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
-----------------------------------------------------
  2 |     !  "  #  $  %  &  '  (  )  *  +  ,  -  .  /
  3 |  0  1  2  3  4  5  6  7  8  9  :  ;  <  =  >  ?
  4 |  @  A  B  C  D  E  F  G  H  I  J  K  L  M  N  O
  5 |  P  Q  R  S  T  U  V  W  X  Y  Z  [  \  ]  ^  _
  6 |  `  a  b  c  d  e  f  g  h  i  j  k  l  m  n  o
  7 |  p  q  r  s  t  u  v  w  x  y  z  {  |  }  ~  ⌂
  8 |  Ç  ü  é  â  ä  à  å  ç  ê  ë  è  ï  î  ì  Ä  Å
  9 |  É  æ  Æ  ô  ö  ò  û  ù  ÿ  Ö  Ü  ¢  £  ¥  ₧  ƒ
  A |  á  í  ó  ú  ñ  Ñ  ª  º  ¿  ⌐  ¬  ½  ¼  ¡  «  »
  B |  ░  ▒  ▓  │  ┤  ╡  ╢  ╖  ╕  ╣  ║  ╗  ╝  ╜  ╛  ┐
  C |  └  ┴  ┬  ├  ─  ┼  ╞  ╟  ╚  ╔  ╩  ╦  ╠  ═  ╬  ╧
  D |  ╨  ╤  ╥  ╙  ╘  ╒  ╓  ╫  ╪  ┘  ┌  █  ▄  ▌  ▐  ▀
  E |  α  ß  Γ  π  Σ  σ  µ  τ  Φ  Θ  Ω  δ  ∞  φ  ε  ∩
  F |  ≡  ±  ≥  ≤  ⌠  ⌡  ÷  ≈  °  ∙  ·  √  ⁿ  ²  ■


--------------------------------
Process exited after 0.7244 seconds with return value 0
Press any key to continue . . .
```