National Chiao Tung University
Department of Communication Engineering
Computer Intelligence on Automation(C.I.A.) Lab

Midterm Exam - Programming
Nov 11, 2008
Prof. Hung-Pin(Charles) Wen

UEE1302(1066): Midterm Examination

-- Programming Part --

FULL SCORES:

120%

EXAMINATION TIME:

180 minutes

INSTRUCTIONS:

Problems are classified into 3 different levels according to the difficulties: Easy, Moderate and Hard. You may pick arbitrary numbers of problems to solve with a total score up to 120% where scores from Moderate and Hard levels should at least be 40% and 30%, respectively.

You are allowed open any notes or books but prohibited to browse on the internet to search answers directly. Read carefully the statements and requirements of each problem. Once you complete your program for one problem, please raise your hand and TA will come to your desk for testing. Please note that <u>no credit</u> will be given if your program fails to fully meet the requirement in each problem. Good luck!

UEE1302(1066): Midterm Examination

-- Programming Part --

FULL SCORES:120 points

ID NUMBER(學號)：_____

FULL NAME(姓名)：_____

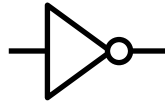| Easy Level (10 points)		Moderate Level (20 points)		Hard Level (30 points)	
題號	助教簽名	題號	助教簽名	題號	助教簽名
01		07		13	
02		08		14	
03		09		15	
04		10		16	
05		11			
06		12			

【EASY LEVEL】

PROBLEM 01 (10%)

Logic simulation problem
True table of each gate

A	Out
0	1
1	0

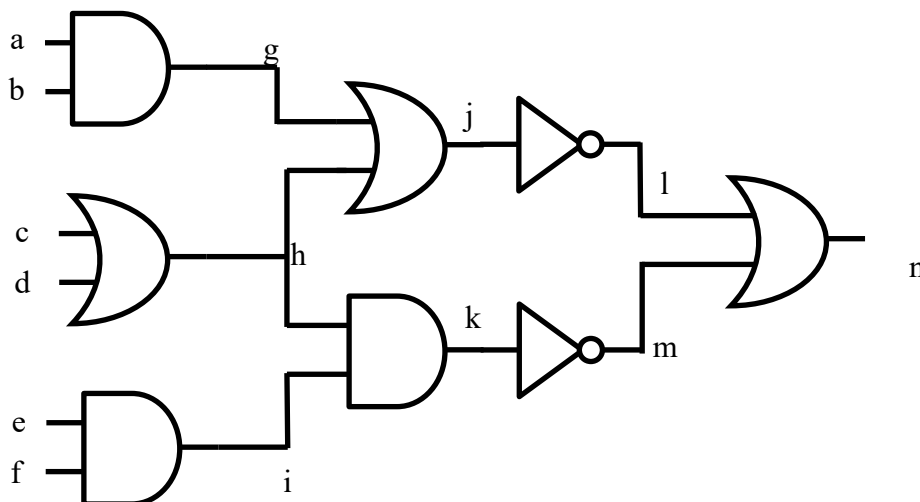| A	B	Out
0	0	0
0	1	0
1	0	0
1	1	1
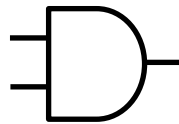
A	B	Out
0	0	0
0	1	1
1	0	1
1	1	1
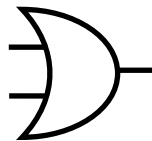
Acorrding the circuit as follow, write the program has 6 input value and show the value of each net

National Chiao Tung University   Midterm Exam - Programming
Department of Communication Engineering   Nov 11, 2008
Computer Intelligence on Automation(C.I.A.) Lab   Prof. Hung-Pin(Charles) Wen

(Ex) >./pg01

  Enter a b c d e f value:

  Enter : **1 0 1 1 0 0** ↵

  Wire value g h i j k l m n

  0 1 0 1 0 0 1 1

  >

(Ex) >./pg01

  Enter a b c d e f value:

  Enter : **1 1 1 1 1 1** ↵

  Wire value g h i j k l m n

  1 1 1 1 1 0 0 0

  >

PROBLEM 02 (10%)

As a number entered, you should print all of its factor multiplication terms.
Ex. 45=5*9 is a factor multiplication terms of 45.

(Ex) >./pg02

  Enter a number: **45** ↵

  45 = 1 * 45

  45 = 3 * 15

  45 = 5 * 9

  45 = 9 * 5

  45 = 15 * 3

  45 = 45 * 1

   >

(Ex) >./pg02

  Enter a number: **79** ↵

  79 = 1 * 79

  79 = 79 * 1

  >

PROBLEM 03 (10%)

Please write a C++ program to ask the user to enter an integer x and then show on screen if the given *X* is a 6-multiple. The required format is shown as follows.
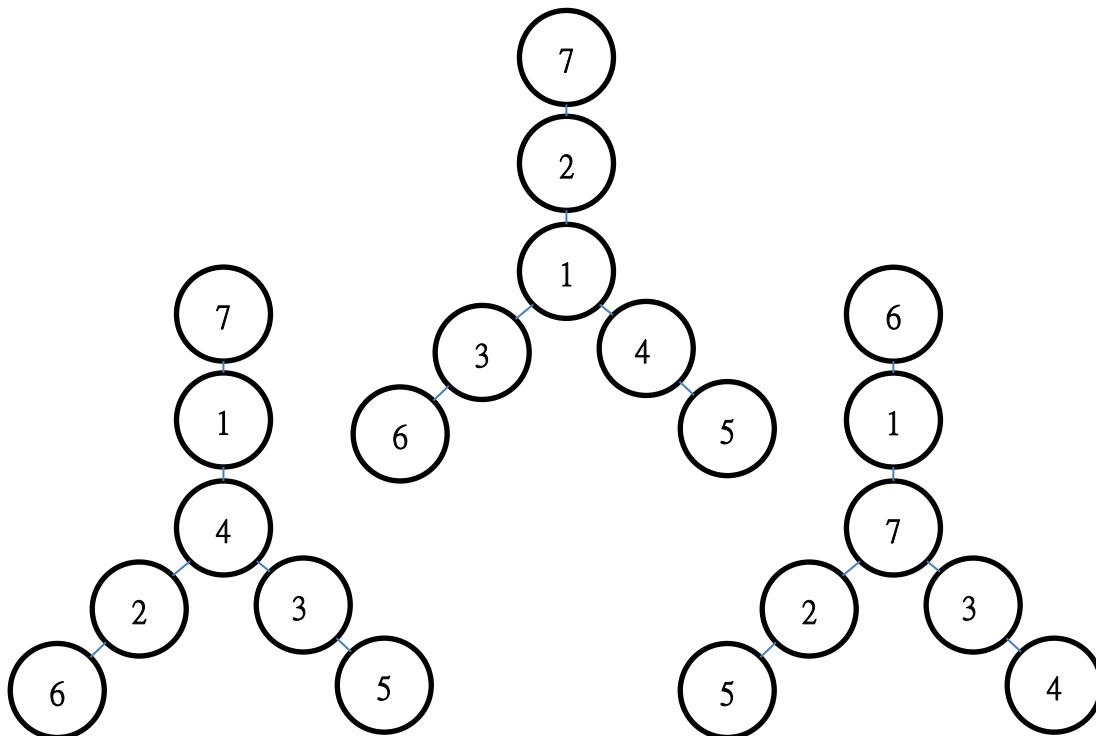
(Ex)   >./pg02
        Enter X: *30* [↵]
        30 is a 6-multiple.
        >

(Ex)   >./pg02
        Enter X: *23* [↵]
        23 is not a 6-multiple.
        >

PROBLEM 04 (10%)

There are seven continue number, but we don't know which number is first. The seven numbers will fill in the figure as follow, and the sum of each line (including three nodes) is same. Find all kind center nodes are match the condition and print the sum of each line.

For example if we chose number 1~7 and fill in nodes, the result is match the condition. We can find the result of filling is match if the center node is 1.

(Ex) >./pg03

Enter first number: *1* ⏎

(center number, sum of each line)

Ans 1: 1 10

Ans 2: 4 12

Ans 3: 7 14

\>

(Ex) >./pg03

Enter first number: *5* ⏎

(cneter number, sum of each line)

Ans 1: 5 22

Ans 2: 8 24

Ans 3: 11 26

\>

PROBLEM 05 (10%)

The complex number multiplication

Please write a c++ program to complete the complex number multiplication

$$(a+bi)*(c+di)=(ac-bd)+(ac+bd)i$$

(Ex) >./pg00

The real part of first number is : 3.2 ⏎

The imagianry part of first number is : -1.8 ⏎

The real part of second number is : 1 ⏎

The imagianry part of second number is : 2.0 ⏎

The result of multiplication is :

(3.2-1.8i)*(1.0+2.0i)=6.8-4.6i

\>

(Ex) >./pg00

The real part of first number is : 1 ⏎

The imagianry part of first number is : 1 ⏎

The real part of second number is : 1 ⏎

The imagianry part of second number is : -1 ⏎

The result of multiplication is :

(1.0+1.0i)*(1.0-1.0i)=2

\>

National Chiao Tung University
Department of Communication Engineering
Computer Intelligence on Automation(C.I.A.) Lab

Midterm Exam - Programming
Nov 11, 2008
Prof. Hung-Pin(Charles) Wen

PROBLEM 06 (10%)

A golden rectangle is one whose side lengths are in the golden ratio, $1:\frac{1+\sqrt{5}}{2}$,
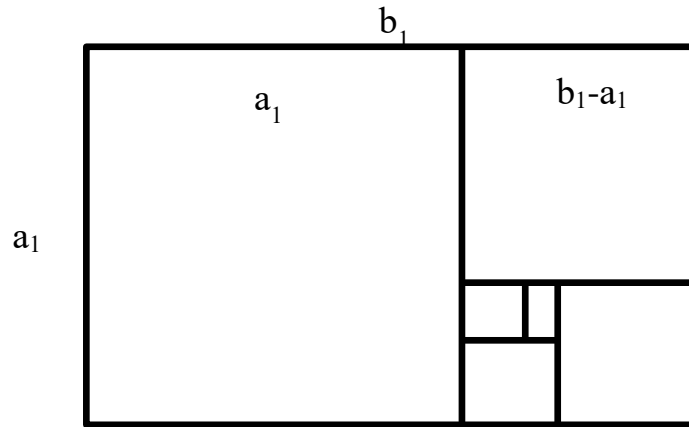
The golden rectangle $a_1 : b_1 = 1:\frac{1+\sqrt{5}}{2}$, and cut a aquare with the side a_1. It

will create a new golden rectangle $(b_1 - a_1): a_1 = 1:\frac{1+\sqrt{5}}{2}$.

Now input width a_1 ,and find the times of cuting that the new width a_n is smaller than 0.1

(Ex)   >./pg06

    Enter a_1: **10** ⏎

    Cut times : 10

    >

(Ex)   >./pg06

    Enter n: **20** ⏎

    Cut times : 12

    >

National Chiao Tung University   Midterm Exam - Programming
Department of Communication Engineering   Nov 11, 2008
Computer Intelligence on Automation(C.I.A.) Lab   Prof. Hung-Pin(Charles) Wen

【MODERATE LEVEL】

PROBLEM 07 (20%)

UltimateCode

Please write a C++ program to produce a code number in [1,100] randomly. And the program will ask a player to guess this number.

If the guess number is bigger than the code, the program will inform the player that code number is bigger. If the guess number is smaller than the code, the program will inform the player that code number is small. Until the player guess the right code. Finally, program tells player how many times you guess.

(Ex)   >./pg07

        Welcome to play UltimateCode

        The code number has produced, you can start to guess now.

        50   ↵

        The code number is in [51,100]

        75   ↵

        The code number is in [51,74]

        67   ↵

        Correct !!   And you guess 3 times totally

        >

(Ex)   >./pg07

        Welcome to play UltimateCode

        The code number has produced, you can start to guess now.

        65   ↵

        The code number is in [1,65]

        70   ↵

        BOOM !! You fail

        >

National Chiao Tung University   Midterm Exam - Programming
Department of Communication Engineering   Nov 11, 2008
Computer Intelligence on Automation(C.I.A.) Lab   Prof. Hung-Pin(Charles) Wen

PROBLEM 08 (20%)

Given an unsigned integer, please count the total numbers of each figure in the integer. Note that you should not output the figure if it doesn't exist in the integer.

(Ex) >./pg08

       Please enter a number: *122333* ⏎

       The count of one: 1

       The count of two: 2

       The count of three: 3

       >

(Ex) >./pg08

       Please enter a number: *5220499* ⏎

       The count of zero: 1

       The count of two: 2

       The count of four: 1

       The count of five: 1

       The count of nine: 2

       >

PROBLEM 09 (20%)

Please write a C/C++ program to judge three people play paper, scissors, rock. In this program, two people should be input by user, the other should be randomly generated. The required format is shown as follows.

(Ex)   >./pg09

       Please enter two gesture : *s s* ⏎

       Third person: stone

       The third person win!!

       >

PROBLEM 10 (20%)

There is a 3 rounds poker card game: Computer and you individually get one random card at same round. One who gets bigger number card wins the round. Spade is bigger than Heart, Heart is bigger than Diamond, and Diamond is bigger than Clubs while the number of cards is the same. Computer and you would not get the same cards in the same round. And for one who won the first two round directly win the whole poker card game, in other words, the third round will NOT be held if there is anyone who already won two rounds.

(Ex1) >./pg10

        ==========Round 1==========
        The card you get is Clubs J
        The card computer gets is Spade Q
        You lose in round 1
        ==========Round 2==========
        The card you get is Spade 9
        The card computer gets is Diamond 6
        You win in round 2
        ==========Round 3==========
        The card you get is Heart 2
        The card computer gets is Heart K
        You lose in round 3
        Finally you lose the game!!
        >
(Ex1) >./pg10

        ==========Round 1==========
        The card you get is Clubs 10
        The card computer gets is Heart 5
        You win in round 1
        ==========Round 2==========
        The card you get is Spade Q
        The card computer gets is Diamond J
        You win in round 2
        Finally you win the game!!
        >

PROBLEM11 (20%)

Chin jiou shau 's formula

In Song of Southern dynasties, mathematician Chin jiou shau had known the formula of area of triangle. if we have the length of three sides we can use the formula to get the area. The formula is:

$$s = \sqrt{\frac{1}{4}(a^2c^2 - (\frac{a^2 + c^2 - b^2}{2})^2)}$$

S is area, a, b and c are the length of sides (a>b>c).

Please write a C++ program that asks user to give three sides a, b and c, then the program will give the area of that triangle. If the sides cannot establish a triangle. The program should print the error message

(Ex)   >./pg11

Please give three sides

5 4 3 ↵

I get You. The area is 6

>

(Ex)   >./pg11

Please give three sides

3 10 2 ↵

Error! These three sides can't produce a trangle

>

PROBLEM12 (20%)

Please write C/C++ program to print the article as follows.

National Chiao Tung University
Department of Communication Engineering
Computer Intelligence on Automation(C.I.A.) Lab

Midterm Exam - Programming
Nov 11, 2008
Prof. Hung-Pin(Charles) Wen

【HARD LEVEL】

PROBLEM 13 (30%)

In mathematics, a unit circle is a circle with a radius of one. Frequently, especially in trigonometry, the unit circle is the circle of radius one centered at the origin (0, 0) in the Cartesian coordinate system in the Euclidean plane. The function of unit circuit as follow
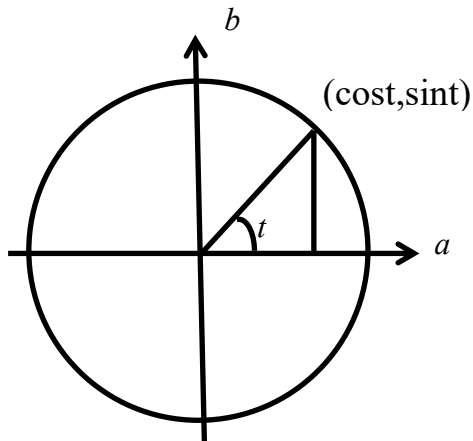
$$sin^2 t + cos^2 t = 1$$

Trigonometric function can be represent by Taylor series. One can then use the theory of Taylor series to show that the following identities hold for all real numbers x

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots$$

$$\cos x = x - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \cdots$$

Please write C/C++ program that the user to enter the degree t prove the unit circle function. Your program should calculate cost, sint and $sin^2 t + cos^2 t = 1$. Examples of the required format are shown as follows.

Hit:enter degree 60. Pi = 3.141592654, $x = \frac{\pi}{180} \times 60 = 1.048197551$

(Ex) >./pg13
    Enter *t*: **15** ⏎
    cos*t* = 0.965926
    sin*t* = 0.258819
    (sin*t**sin*t*)+(cos*t**cos*t*)= 0.066987 + 0.933013 = 1.000000
    >

(Ex) >./pg13
    Enter *t*: **30** ⏎
    cos*t* = 0.866025
    sin*t* = 0.500000
    (sin*t**sin*t*)+(cos*t**cos*t*)= 0.250000 + 0.750000 = 1.000000
    >

National Chiao Tung University
Department of Communication Engineering
Computer Intelligence on Automation(C.I.A.) Lab

Midterm Exam - Programming
Nov 11, 2008
Prof. Hung-Pin(Charles) Wen

PROBLEM 14 (30%)

The mathematical constant π can be represented as an infinite simple continued fraction due to Euler

$$\pi = 3 + \cfrac{1^2}{6+\cfrac{3^2}{6+\cfrac{5^2}{6+\cfrac{7^2}{6+\cfrac{9^2}{6+\ddots}}}}} = 3 + \cfrac{a_1^2}{6+\cfrac{a_2^2}{6+\cfrac{a_3^2}{6+\cfrac{a_4^2}{6+\cfrac{a_5^2}{6+\ddots}}}}}$$

$$\pi(1) = 3 + \frac{1}{6} = 3.166667, \pi(2) = 3 + \cfrac{1}{6+\frac{9}{6}} = 3.133333,$$

$$\pi(3) = 3 + \cfrac{1^2}{6 + \cfrac{9}{6 + \cfrac{25}{6}}} = 3.145238$$

Please write a C/C++ program that allows the user to enter an integer n for an as the number of divisions. Your program should calculate π the basis of the above formula and then display the number to 6 decimal places. Examples of the required format are shown as follows.

(Ex)   >./pg14

      Enter n: *10* ⏎

      Pi(10) = 3.141407

      >

(Ex)   >./pg14

      Enter n: *100* ⏎

      Pi(100) = 3.1415926

      >

National Chiao Tung University   Midterm Exam - Programming
Department of Communication Engineering   Nov 11, 2008
Computer Intelligence on Automation(C.I.A.) Lab   Prof. Hung-Pin(Charles) Wen

<u>**PROBLEM 15**</u> **(30%)**

Please convert a number in decimal to other number system expression; **only binary to hexadecimal will be given**, for instance, 79 in decimal can be converted to 1001111 in binary and also 1033 in quaternary, 4F in Hexadecimal. Note that the figure of converted number should be A~F (A=10, B=11 …F=15) if the figure is over 9.

$$79 = 1 \times 2^6 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \quad \rightarrow 1001111(2)$$
$$79 = 1 \times 4^3 + 3 \times 4^1 + 3 \times 4^0 \qquad\qquad\qquad \rightarrow \quad\;\; 1033(4)$$
$$79 = 4 \times 16^1 + 15 \times 16^0 \qquad\qquad\qquad\qquad \rightarrow \quad\;\;\; 4F(14)$$

(Ex) >./pg15

     Please enter a decimal number: **188** ⎵↵

     Enter the number of system you want to convert (only for binary ~ hexadecimal):**16** ↵

     The number 188 (10) is converted to BC (16)

     >

(Ex2) >./pg15

     Please enter a decimal number: **76** ⎵↵

     Enter the number of system you want to convert (only for binary ~ hexadecimal): **13** ↵

     The number 76 (10) is converted to 5B (13)

     >

<u>**PROBLEM 16**</u> **(30%)**

Please output a Christmas tree, which level of the tree is user-defined.

The top of the tree is a start: **"*"**; the levels of tree are **mixed with ~ and _**: /_~_~_\ (lv.3); and bottom of tree is **<T>** in the middle.

(Ex1) >./pg16

     Please enter the level of Christmas tree: **5** ⎵↵

```
    "*"
    /_\
   /_~_\
  /_~_~_\
 /_~_~_~_\
/_~_~_~_~_\
    <T>
```

     >

(Ex2) >./pg16

     Please enter the level of Christmas tree: 2 ⎵↵

```
    "*"
```

```
  /_\
 /_~_\
  <T>
  >
```