Swinburne University of Technology Sarawak

COS10009 Introduction to Programming – Semester 1 / 2018

Control Structure – Selection (Lab 03)

Core Task 1

To Do

Floating Points Comparison

Open the *"DoubleTrouble.c"* program with Quincy. Compile, link, run it.
Why does it find that the two numbers x and y are not equal?

Comparisons between floating point (double) numbers are not reliable. In particular, the = = comparison tends to return false. To compare for equality, therefore, we have to decide on a very small number (**1.0e-15**) that we will consider to be a negligible difference. If two floating point numbers differ by less than this value, then they will be considered equal.

Re-write the comparison of equality so that **x** and **y** are equal if the absolute value of their difference is less than 1.0×10^{-15}.
Hint: find the mathematical function listed below. You will need to #include <math.h>.

fabs(x) Absolute value of double x.
abs (i) Absolute value of int i
sqrt(x) Square root of x, where x >= 0.
pow(x,y) Exponentiation, xy. Errors occur if x < 0 or y < 0.
ceil(x) Rounds x to the nearest integer toward ∞ (infinity).
*   eg, ceil(2.01) is equal to 3.*
floor(x) Rounds x to the nearest integer toward -∞ negative infinity).
*   e.g., floor(2.01) is equal to 2.*
exp(x) Computes the value of ex.

Core Task 2

To Do

Nested If Else Structure :

For these exercises use paper and pencil, or Microsoft Powerpoint or Word.

Draw a flowchart to represent a temperature reading from a sensor inside a large piece of machinery as stated below:

Start:
Step 1 : Read temperature
Step 2 : Read status of backup power (on/off)
Step 3 : If temperature is less than 50 degree Celsius, print "Normal mode of operation", then go to Step 1.
Step 4: If temperature is between then 50 to 80 degree Celsius, print "Turn on circulating fan", then go to Step 1.
Step 5: if temperature is more than 80 degree Celsius AND backup power is off, print "Turn equipment off immediately". Then, print the lowest temperature recorded during the operation. (assuming the starting temperature is 38 degree Celsius). Otherwise, go to Step 1.
End

Once you have completed your flowchart, implement the selection structure in your flowchart by using IF ELSE statements in C programming
. You do not need to include the implementation of loop structure at this stage. (The program will only prompt for the input of temperature once, and display either "Normal mode of operation", "Turn on circulating fan" or "Turn equipment off immediately")

Core Task 3

To Do

Calculating Leap Year:

In the Gregorian calendar, a normal year consists of 365 days. Because the actual length of a sidereal year (the time required for the Earth to revolve once about the Sun) is actually 365.25635 days, a "leap year" of 366 days is used once every four years to eliminate the error caused by three normal (but short) years. Any year that is evenly divisible by 4 is a leap year: for example, 1988, 1992, and 1996 are leap years.

However, there is still a small error that must be accounted for. To eliminate this error, the Gregorian calendar stipulates that a year that is evenly divisible by 100 (for example, 1900) is a leap year only if it is also evenly divisible by 400.

For this reason, the following years are not leap years:
1700, 1800, 1900, 2100, 2200, 2300, 2500, 2600

Write a C program to determine whether a year entered by user is a leap year. (You are advised to draw a flow chart before start writing your codes).

Hand Execution:

In every assignment statement and input statement, a value will be assigned into a variable. In this task, you will demonstrate how this action works within the computer for the program you have developed above (core task 3).

Hand execution process:
Download hand execution sheet (hand.doc) from the Black Board, write and list down all the variables in your program. Whenever there is an assignment of new value into a variable, update the values of all the variables and the corresponding output by adding a new row to the hand execution sheet.

Vital Task

To Do

Displaying four integers in ascending and descending order

Develop a C program that prompts user to enter four integers (in any order), it will then display those four integers in both ascending and descending order as the output.

Challenge Task

To Do

Factoring if/else code

Extracting common/redundant code from the following selection structure (assuming all the variables have been declared):

```
If (num == 1)
{
        printf("%i", num);
        x = 3;
        b = b + x;
}
else if (num == 2)
{
        printf("%i", num);
        x = 6;
        y = y + 10;
        b = b + x;

}
else
{
        printf("%i", num);
        x = 9;
        b = b + x;
}
```

Hints : The code above can be written with only four statements.