Ollscoil Mhá Nuad
Ollscoil na hÉireann Má Nuad

CS161FZ Introduction to Computer Science

Lab Assignment 3

There are four tasks to be completed.

Task 1: Wind-Chill Temperature Calculator.

Today, the weather forecast reported that the temperature for day time is 22°C. However, when you are riding your scooter to school, you will feel much colder. The reported temperature alone is not enough to offer a true answer. Other factors, such as, wind speed, humidity and lightning condition, are also important to determine the temperature. This is often called the Wind-Chill temperature.

The National Weather Service (NWS) has created a formula for calculating wind-chill temperatures, as shown below:

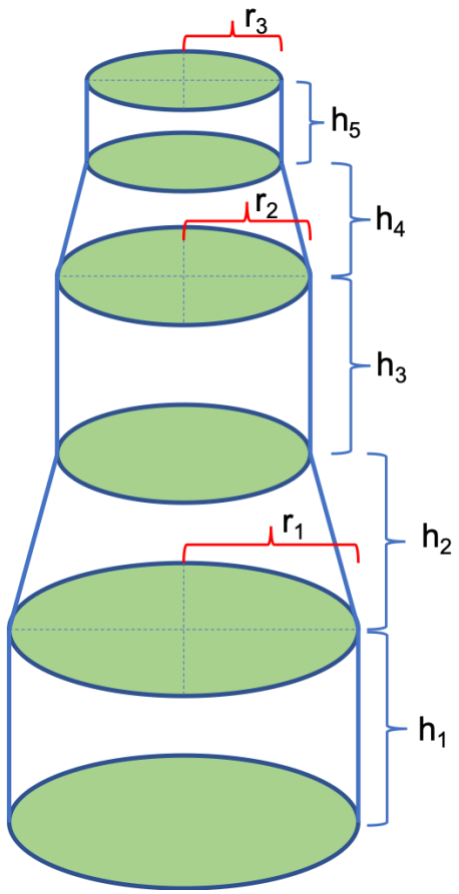
$$T_{wc} = 35.74 + 0.6215 * T_F - 35.75 * v^{0.16} + 0.4275 * T_F * v^{0.16}$$

where T_{wc} is the wind-chill temperature, T_F is the reported temperature measured in degree Fahrenheit, v is the speed of your driving measured in miles per hour. However, the formula does NOT work when your driving speed is below 2 miles per hour or the reported temperature is below -51 degree Fahrenheit or above 41 degrees Fahrenheit.

Your first task is to write a program to calculate wind-chill temperature. Given driving speed of 20 miles/hour and reported temperature 31.4 degrees Fahrenheit, your program needs to print the corresponding wind-chill temperature in degrees Celsius, on screen.

Note: You may use the "*Math.pow(a, b)*" to calculate the power, e.g., a^b and "*Math.sqrt(a)*" to calculate the square root, e.g., $\sqrt[2]{a}$. Each function returns a value of double type. You do NOT have to use "Scanner" inputs. Your source file name should be "WCTCalculator".

Task 2: Container Volume Calculator.



Calculate volume of containers is a very common task in engineering science. The shape of a container, as shown on the left, consists of three cylinder sections and two cone sections. Using the formulas for the volume of a cylinder,

$$V = \pi r^2 h$$

and the formulas for the volume of a cone:

$$V = \pi \frac{(r_{bottom}^2 + r_{bottom}r_{top} + r_{top}^2)h}{3}$$

Your task is to develop a program to compute the volume of the container.

{r1 = 23.5cm, r2 = 17.39cm, r3 = 4.39cm}
{h1 = 243.293mm, h2 = 231.6mm, h3 = 310mm, h4 = 200mm, h5 = 119.999mm}

Note: Your source file name should be “VolumeCalculator”.

Task 3: Easter Sunday Calculator

In Ireland, very year, we celebrate the first Sunday after the first full moon of spring, we call it Easter Sunday. The date of Easter Sunday is different from year ot year. To compute the date, one of the greatest mathematician Carl Friedrich Gauss has developed an algorithm for us, in year 1800:

1. Given a year, divide the year by 19 and keep the remainder0.
2. Divide the year by 100 to get a quotient1 and a remainder1.
3. Divide the quotient1 from Step-2 by 4 to get a quotient2 and a reminder2.
4. Divide 8 times the quotient from Step-2 plus 13 by 25 to get a quotient3.
5. Divide 19 times the remainder0 from Step-1 plus the quotient 1from Step-2 minus the quotient2 from Step-3 minus the quotient3 from step 4 plus 15 by 30 to get a remainder3.
6. Divide the remainder1 from Step-2 by 4 to get a quotient4and a remainder4.
7. Divide the remainder0 from Step-1 plus 11 times the remainder3 from Step-5 by 319 to get a quotient5.
8. Divide 2 times the reminder2 from Step-3 plus 2 times the quotient4 from Step-6 minus the remainder4 from Step-6 minus the remainder3 from Step-5 plus the quotient5 from Step-7 plus 32 by 7 to get a remainder6.
9. Divide the remainder3 from Step-5 minus the quotient5 from Step-7 plus the remainder6 from Step-8 plus 90 by 25 to get a quotient7
10. Divide the remainder3 from Step-5 minus the quotient5 from Step-7 plus the remainder6 from Step-8 plus the quotient7 from Step-9 plus 19 by 32 to get a remainder8.

Then, the Easter falls on day, the remainder from Step-10, of month, the quotient from Step-9.

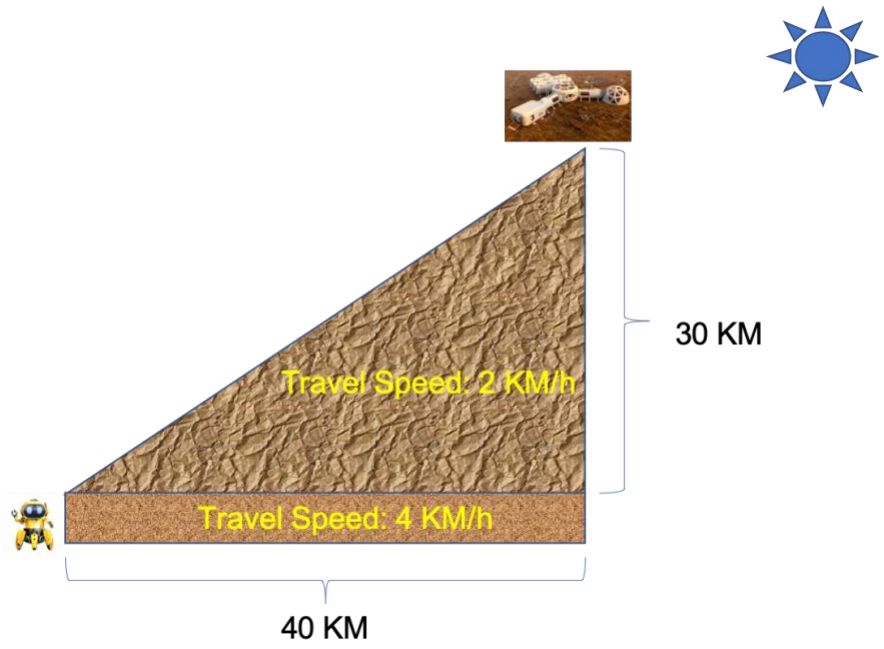
For example, the Easter day in 2018 was on the 1st of April.

Your task is to write a program to calculate the Easter day for year 2020.

Note, your source file name should be “EasterSunday”. You should print the day, month and year on each line.

Task 4: BetaBack is Going Back to Base

The robot BetaBack is running back to the base on Mars. The energy source of BetaBack is completely from its built-in solar panel. The sun is setting in exactly 23.4 hours. BetaBack must go back to the base before the sunset. There are two types of path for BetaBack, rough road and flat road. BetaBack can run 4KM/h on flat road and 2KM/h on rough road. Additionally, when BetaBack runs on rough road, his tire worn two times faster than running on flat road. The distance between BetaBack and the base is shown in the image below. Your task is to write a program for BetaBack to run back to base in exactly 23.4 hours, at the same time, minimize the tire worn speed. You program should output two values. The first value is the travel distance on flat road and the second value is the travel distance on rough road. The two values should be printed on separate lines.
Test your program when the length of the flat road is 55KM, the length of rough road is 37KM, travel speed on flat road is 4.6KM/h, travel speed on rough road is 2.4KM/h, and make sure BetaBack will be back to base in exactly 25.2 hours.



Your source file name should be “BetaBack”.