**Every Boiler Engineering Code – Entry Level Programming**

**Week 2 – Programming Exercises**

**Note: Please add appropriate statements for input in your code. (e.g. ‘Please input a year: ’or ‘Please input the velocity in m/s: ’ )**

1. **(****10 points Leap Year)** The month of February normally has 28 days. But if it is a leap year, February has 29 days. Write a Python program that asks the user to enter a year. The program should then display the number of days in February that year. Use the following criteria to identify leap years:
   * Determine whether the year is divisible by 100. If it is, then it is a leap year if and only if it is also divisible by 400. For example, 2000 is a leap year, but 2100 is not.
   * If the year is not divisible by 100, then it is a leap year if and only if it is divisible by 4. For example, 2004 is a leap year, but 2006 is not.

**Use the following numbers to test:**

|  |  |
| --- | --- |
| **Input** | **Expected Output** |
| **2016** | **There are 29 days in February in 2016** |
| **2018** | **There are 28 days in February in 2018** |
| **1900** | **There are 28 days in February in 1900** |
| **2000** | **There are 29 days in February in 2000** |

1. **(10 points Software Sales)** A software company sells a package that retails for $99. Quantity discounts are given according to the following tables:

|  |  |
| --- | --- |
| **Quantity** | **Discount** |
| **10-19** | **10%** |
| **20-49** | **25%** |
| **50-99** | **35%** |
| **100 or more** | **45%** |

Write a Python program that asks the user to enter the number of packages purchased. The program should then display the amount of the discount (of any) and the total amount of the purchase after the discount. (**Note:** **the precision of output must be set to 2, the output must be formatted with comma separators and with the ‘$’ sign.**)

**Use the following numbers to test:**

|  |  |
| --- | --- |
| **Input** | **Expected Output** |
| **-5** | **Invalid Input!** |
| **9** | **No discount applied**  **The final price for purchasing 9 packages is $ 891.00** |
| **45** | **25% discount applied**  **The final price for purchasing 45 packages is $ 3,341.25** |
| **76** | **35% discount applied**  **The final price for purchasing 76 packages is $ 4,890.60** |
| **201** | **45% discount applied**  **The final price for purchasing 201 packages is $ 10,944.45** |

1. **(10 points Roulette Wheel Colors)** On a roulette wheel, the pockets are numbered from 0 to 36. The colors of the pockets are as follows:
   * Pocket 0 is green.
   * For pockets 1 through 10, the odd-numbered pockets are red and the even-number pocket are black.
   * For pocket 11 through 18, the odd-number pockets are black and even-numbered pocket are red.
   * For pockets 19 through 28, the odd-numbered pockets are red and the even-numbered pocket are black.
   * For pockets 29 through 36, the odd-numbered pockets are black and the even-numbered pocket are red.

Write a Python program that asks the user to enter a pocket number and displays whether the pocket is green, red, or black. The program should display an error message if the user enters a number that is outside the range of 0 through 36.

**Use the following numbers to test:**

|  |  |
| --- | --- |
| **Input** | **Expected Output** |
| **41** | **Invalid Input!** |
| **7** | **The pocket 7 is red.** |
| **11** | **The pocket 11 is black.** |
| **20** | **The pocket 20 is black.** |
| **36** | **The pocket 36 is red.** |

1. **(10 points Time Calculator)** Write a program that asks the user to enter a number of seconds and works as follows:
   * There are 60 seconds in a minute. If the number of seconds entered by the user is greater than or equal to 60, the program should convert the number of seconds to minutes and seconds.
   * There are 3,600 seconds in an hour. If the number of seconds entered by the user is greater than or equal to 3,600, the program should convert the number of seconds to hours, minutes, and seconds.
   * There are 86,400 seconds in a day. If the number of seconds entered by the user is greater than or equal to 86,4000, the program should convert the number of seconds to days, hours, minutes, and seconds.
   * If the number of seconds entered by the user is less than 60, the program should display a message to tell the user the input number is less than a minute.

**Use the following numbers to test:**

|  |  |
| --- | --- |
| **Input** | **Expected Output** |
| **23** | **The number of seconds is less than one minute.** |
| **233** | **233 seconds equal to: 3 full minute(s) and 53 second(s).** |
| **23333** | **23333 seconds equal to: 6 full hour(s), 28 full minute(s) and 53 second(s).** |
| **233333** | **233333 seconds equal to: 2 full day(s), 16 full hour(s), 48 full minute(s) and 53 second(s).** |

1. **(10 points Fluid Mechanics)** A key parameter used to determine the type of fluid flow through a pipe is the Reynolds numbers. Which is given by this formula:

**Re = (V x *d*) /*v***

Re is the Reynolds number (a dimensionless value)

V is the velocity (m/s or ft/sec)

*d* is the diameter of the pipe (m or ft)

*v* is the kinematic viscosity of the fluid (m/s2 or ft/sec2)

The kinematic viscosity, *v*, is a measure of the fluid’s resistance to flow and stress. Except at extremely high pressures, a liquid fluid’s kinematic viscosity is dependent on temperature and independent of pressure. The following chart lists the kinematic viscosity of water at three different temperatures:

|  |  |
| --- | --- |
| **Temperature (0C)** | **Kinematic Viscosity (m/s2)** |
| 5 | 1.49 x 10-6 |
| 10 | 1.31 x 10-6 |
| 15 | 1.15 x 10-6 |

Using this information, write a Python program that requests the velocity of water flowing through a pipe (V), the pipe’s diameter (*d*), the water’s temperature (ask user select from 5, 10, and 15). Based the input values, your program should calculate the Reynolds number. (**Note: The output should be formatted in scientific notation. The precision of output must be set to 2.**) (**Hint:** **The string for printing ° is ‘\u00B0’, which is the Unicode for this symbol.**)

**Use the following numbers to test:**

|  |  |
| --- | --- |
| **Input** | **Expected Output** |
| **V=0.01**  **d=0.01**  **T=5** | **The Reynolds number for a flow at a speed of 0.01 m/s in a pipe with 0.01 m diameter @ 5.0 °C is 6.71e+01** |
| **V=0.1**  **d=0.1**  **T=10** | **The Reynolds number for a flow at a speed of 0.1 m/s in a pipe with 0.1 m diameter @ 10.0 °C is 7.63e+03** |
| **V=3.5**  **d=2**  **T=15** | **The Reynolds number for a flow at a speed of 3.5 m/s in a pipe with 2.0 m diameter @ 15.0 °C is 6.09e+06** |