**ENGR 102**

**Lab # 4BONUS (Individual) [100 Points]**

**Program 1: [50 Points]**

Reynold Number () is a dimensionless parameter that describes the ratio of inertial forces to viscous forces for a particular fluid flow. The value of is an indication of whether the flow is laminar, in transition, or turbulent. For flow in a pipe, the Reynolds number is defined as follows:

Where is a characteristic velocity of the flow

is the pipe diameter

is the fluid kinematic viscosity

Please note that you must pay attention to the units of these parameters so that they will cancel each other during the calculation and leave the result dimensionless. For this exercise, let’s stay with SI units as shown above.

Write a program to calculate the Reynolds number for a pipe flow and report whether the flow is laminar, in transition, or turbulent. It is generally accepted for pipe flows that the flow is laminar for and fully turbulent for and in transition between those limits. The program should ask for the required parameter values to be entered via the keyboard and output the calculated value and whether the flow is laminar, in transition, or turbulent.

Just for fun (meaning not required, not to turn in, not for extra credit, but simply for the fun of doing it): Hard code the viscosity values for three different fluids in your code. Then have the code prompt the user to enter, for example, “water” or “air” or “oil” followed by the velocity, and pipe diameter. Have your code chose the appropriate viscosity value for the calculations based on the user input. Calculate and print the Reynolds number and whether the flow is laminar, in transition, or turbulent. For this problem, it’s probably a good idea to print which fluid was used and then echo the input values for velocity and pipe diameter.

**Program 2: [50 Points]**

Assume a machine during its initial testing phase produces 10 widgets a day. After 10 days of testing (starting on day 11), it begins to run at full speed, producing 40 widgets a day. After 50 days at full speed (days 11-60), it gradually starts becoming less productive, and produces 1 fewer widget per day, (ie. 39 widgets on day 61, etc.) until on day 100 it no longer produces any widgets. Write a program that will read in a day number from the keyboard and will report the total number of widgets produced from the initial testing phase up to and including the day entered. For example, entering 3 would report 30 widgets.

Your code should also . . .

* Include the valid range of day numbers on the user prompt
* Check for inappropriate day numbers and message the user accordingly
* Echo the input in the output when you report the number of widgets

(Note: Part of the challenge in this program is for YOU to work out the model for how to compute widgets produced in total, given the above information. Hint: Solve this problem on paper, then implement the solution in Python. A graph or diagram is particularly helpful. YOU DO NOT NEED TO TURN IN YOUR GRAPH. This approach is much easier than debugging some lousy Python code written before you understand the problem.)