CS 158/159 Homework 1

This assignment is worth 15 points and will be **due Monday January22, 2018 at 11:00pm**. All assignment deadlines are firm and the ability to submit your assignment will be disabled after the deadline elapses. No late work will be accepted. You are encouraged to start this assignment as soon as possible so that you have ample time to seek assistance should you experience difficulties completing or submitting this assignment.

This programming assignment does not have a single solution, and the assignment you submit must be your own original work. **Collaboration with other students is not permitted on homework assignments.** Any submission may be processed with comparison software and the results will be used to detect unacceptable collaboration between individuals. If you need assistance, you should only consult course staff regarding your program.

Your program must adhere to the course programming standards (available in the course packet and in Blackboard). Please review this document before submitting your assignment, because failure to adhere to it will result in a reduction in points. Your program must include the designated program header (~cs15x/student/hdrProg) at the top of the program (which can be inserted in `vi` using the `hp` shortcut while in command mode). The header must include an appropriate description of your program and must contain your official Purdue career account e-mail address. Also note that course standards prohibit the use of advanced programming concepts not yet introduced in the course, unless otherwise specified.

Each of the example executions provided below represents a single execution of the program. Your program must accept input and produce output **exactly** as demonstrated in the example executions. Your program will be tested with the data seen in the examples below and an unknown number of additional tests making use of reasonable data. Do not include any example outputs with your submission.

A single program file (with the `.c` extension) must be submitted electronically via the `guru` server. An example submission was conducted during the first week in lab00. Any attempts to submit via another method will be denied consideration. You may make multiple submissions before the deadline, but only the last attempt is retained and graded. All previous submissions will be over-written and cannot be recovered. The submission script will reject the submission of any file that does not compile. A program must compile to be considered for partial credit. You should always check the confirmation e-mail you receive after a submission to verify that you have submitted the correct file, to the correct assignment, and to the correct lab section. If you have a concern regarding how to submit work, please visit course staff prior to the assignment deadline.

Problem: You are analyzing the thrust production (in kN) of a turbojet. Consider at sea-level the atmospheric density to be 1.23 kg/m^3 and atmospheric pressure to be 101,325 Pascals. Fuel is typically added at a rate 5% of the air flow. Using standard SI units will result in an output thrust of Newtons. Positive values for all inputs will be guaranteed. To best match the expected output you should use the data type `double` for all variables.

$$\dot{m}_{air} = \rho V_\infty A_i$$

$$Thrust = (\dot{m}_{air} + \dot{m}_{fuel})V_e - \dot{m}_{air}V_\infty + (p_e - p_\infty)A_e$$

Subscript ∞ refers to freestream conditions (meaning at the inlet). Subscript e signifies the outlet (exit).

Example Execution #1:

```
Enter the inlet speed (m/s)-> 100.4
Enter the outlet speed (m/s)-> 240.9
Enter the inlet area (m^2)-> 1.5
Enter the outlet area (m^2)-> 0.1
Enter the outlet pressure (Pa)-> 87000.2

Given Conditions
-=-=-=-=-=-=-=-=-
Inlet speed (m/s): 100.40
Output speed (m/s): 240.90
Inlet Area (m^2): 1.50
Outlet Area (m^2): 0.10
Outlet Pressure (Pa): 87000.20
-=-=-=-=-=-=-=-=-
Air flow (kg/s): 185.238
Thrust produced (kN): 26.825
```

Example Execution #2:

```
Enter the inlet speed (m/s)-> 100
Enter the outlet speed (m/s)-> 100
Enter the inlet area (m^2)-> 0.5
Enter the outlet area (m^2)-> 0.5
Enter the outlet pressure (Pa)-> 101000

Given Conditions
-=-=-=-=-=-=-=-=-
Inlet speed (m/s): 100.00
Output speed (m/s): 100.00
Inlet Area (m^2): 0.50
Outlet Area (m^2): 0.50
Outlet Pressure (Pa): 101000.00
-=-=-=-=-=-=-=-=-
Air flow (kg/s): 61.500
Thrust produced (kN): 0.145
```

Example Execution #3:

```
Enter the inlet speed (m/s)-> 100
Enter the outlet speed (m/s)-> 300
Enter the inlet area (m^2)-> 1.2
Enter the outlet area (m^2)-> 0.24
Enter the outlet pressure (Pa)-> 100000

Given Conditions
-=-=-=-=-=-=-=-=-
Inlet speed (m/s): 100.00
Output speed (m/s): 300.00
Inlet Area (m^2): 1.20
Outlet Area (m^2): 0.24
Outlet Pressure (Pa): 100000.00
-=-=-=-=-=-=-=-=-
Air flow (kg/s): 147.600
Thrust produced (kN): 31.416
```

Additional Notes:

- All variables should be of the `double` data type.
- Course standards prohibit the use of programming concepts not yet introduced in lecture. For this assignment you can only consider material in the first 3 chapters of the book, notes, and lectures. Use of advanced programming constructs beyond this material would result in a loss of points.

Course Programming Standards Reminders:

- Place a single space between all operators and operands.
- Comment all variables to the right of each declaration. Declare only one variable per line.
- Select meaningful identifiers (names) for all variables in your program.
- Indent all code found within the `main` function exactly two spaces.
- Do not single (or double) space the entire program, use blank lines when appropriate.
- Consider making symbolic/defined constants to represent those values that do not change during the execution of the program.