

ECOR 1606 Practice Lab Midterm #2

The interface pressure between the tire of a locomotive wheel and the hub is given by

$$p = \frac{\delta/b}{\left(\frac{1}{E}\right)\left(1 + \frac{c^2 + b^2}{c^2 - b^2}\right)}$$

where p is the interface pressure (in Pa)

b is the radius of the hub (in m)

c is the radius of the hub plus the tire thickness (in m)

δ is the amount of interference (in m)

E is Young's modulus for the material (use $E = 207 \times 10^9$ Pa)

Write a program that repeatedly reads in hub diameters, tire thicknesses, and interference values (all in m) until -1 -1 -1 is entered. For each set of values entered your program should either

- i) output an error message (if the values are unreasonable: see next paragraph) or
- ii) compute and output the interface pressure.

Hub diameters must be between 0.5 m and 2.5 m (inclusive of these values), tire thicknesses must be between 0.05 m and 0.1 m (inclusive of these values), and interference values must be greater than zero and no more than 0.5% of the diameter.

When -1 -1 -1 is entered your program should output:

- i) the average of all computed interface pressures and
- ii) the greatest interface pressure and the corresponding diameter, tire thickness, and interference values. In the event of a tie either set of values may be output.

Notes:

- Declare E as follows: `const double E = 207e9;`
- The radius of a circle is half of its diameter.
- Due to representation error (conversion from decimal to binary) you may notice strange results when you set the interference value to exactly 0.5% of the diameter. In some cases it may tell you that the inputs are invalid when you would expect them to be valid. Don't worry about this.
- See supplied file "*1606.labfinal.cribsheet.pdf*" for a list of available C- / C++ functions.

If you think any of the above is unclear, run the sample executable provided. We will **not** clarify or explain the question during the actual lab test.

You may wish to refer to supplied file "*1606w14.midterm lab marking.pdf*" for further details on the lab midterm test.

You may write your program using C- or C++. If you choose C++, use supplied file "*framework.cpp*" as your starting point and call your program "*lmp.cpp*". If you choose C-, call your program "*lmp.cmm*" and when you are finished select "Create a C++ Program" from the File menu to save it as a C++ program called "*lmp.cpp*".