Homework #1
Due: 1/26/18

1. (20) Find and cite a news article in the popular press on manufacturing in the U.S. Write a one paragraph summary of the article, including your own assessment of its accuracy.

2. (20) Even though you're still relatively new and inexperienced in your job as a manufacturing engineer, your boss (Prof. Roeder) has asked you to design and manufacture custom hood ornaments (e.g., a Fighting Leprechaun for enthusiastic Irish alums). (a) What are the critical properties for the material? (b) What are some important processing considerations? (c) Based on your analysis, what would be your first logical choice for material(s) and manufacturing process(es)?

3. (20) A metal has a flow curve with parameters K = 650 MPa and a strain hardening exponent n = 0.30. A tensile test specimen of the metal with gage length = 100 mm is stretched to a length of 158 mm. Determine the flow stress at the new length and the average flow stress that the metal has been subjected to during the deformation.

4. (20) Use numerical calculations to show whether the effective stress in plain strain compression is greater or less than that for uniaxial compression. Repeat for the effective strain. In each case, explain why one is greater than the other?

5. (20) An annealed copper sheet, originally 1 mm thick, is to be plastically formed into a hemispherical dome, with outer radius 10 mm, using a pressurized fluid (bulging). The metal's behavior is described by $\bar{\sigma} = 315 \cdot \left(\bar{\varepsilon}\right)^{0.54}$ MPa. The specific heat and density of copper is 385 J/Kg-K and 8970 Kg/m^3.

   (a) Using the von Mises yield criterion, find the maximum internal fluid pressure required to form the dome.
   (b) Calculate the total amount of work done on the material and the temperature rise, assuming the process is adiabatic and the temperature uniform throughout the copper specimen.