Bonus Questions (0.1 points, each)

1. (0.1 points) The Seal of the United States contains the expression, “e pluribus unum.” What does this mean?

2. (0.1 points) The motto of Lafayette College is “Veritas liberabit.” What does this mean?

3. (0.1 points) Which U.S. president threw out the most Opening Day baseballs?

4. (0.1 points) Which university won the first college football game ever played?

5. (0.1 points) What university’s football team is currently ranked 15th in the BCS?

6. (0.1 points) What is the most recent claim to fame for Felix Baumgartner?
1. (15 points). **Steel Bridge Application.** A tension connection will be subjected to an actual load of 4 kips. If one (1) ¼” diameter bolt will be used in double-shear, determine the actual factor of safety with respect to bolt. 
   Given: A sample of the exact same bolt material (same manufacturer, etc.), but in a ½” diameter, was tested in tension, failing at a load of 12.0 kips.

2. (5 points). Explain what an X bolt is and why it is not commonly used.

3. (3 points). TRUE or FALSE. A ¾” Group A Slip Critical bolt has the same nominal strength with respect to the bolt shear limit state as a ¼” Group A N bolt.

4. (50 points). Design (it should not be more than 25% overdesigned) an A36 double-angle tension member that is adequate for the limit states of yielding, fracture, and bolt shear using ASD. Report the allowable loads with respect to each limit state and indicate whether the arrangement is Long Legs Back to Back (LLBB) or Short Legs Back to Back (SLBB).

   Given:
   - Applied axial working load (ASD), \( P = 115 \text{ kips} \)
   - Assume ¼” diameter A325-N (Group A) bolts in a single line, spaced 3” apart.
   - Do not consider the gusset or the limit states of bearing/tearout or block shear.
   - Assume standard holes.
   - Use the \( U = 1 - \frac{x}{L} \) expression.

5. (55 points). **Determine \( P_{\text{all}} = \frac{P_n}{\Omega} \) for the 2L4x3x5/16” double angle member, considering all possible modes.** Circle the final allowable loads for each failure mechanism and clearly identify the controlling allowable load.

   Given:
   - The long legs are back to back (LLBB)
   - Gusset is already adequate (do not check the gusset)
   - A36 material
   - 5/8” Group A (A325) N bolts in standard holes