CE 311 Exam 3
October 16, 2015

You are allowed to have the AISC manual, drawing equipment, and a calculator, only. The AISC manual may contain handwritten notes but may not contain attached sheets nor may any photocopied materials be added to the AISC manual.

**Bonus Questions (0.1 points each)**

1. (0.1 points) Who did the New York Mets beat in the 1969 World Series?

2. (0.1 points) What current U.S. Presidential Candidate was formerly the director of pediatric neurosurgery at Johns Hopkins Hospital?

3. (0.1 points) What current U.S. Presidential Candidate was formerly the Governor of Rhode Island?

4. (0.1 points) What is the combined population of China and India (answer correct if within 10% of 2014 official estimates)?

5. (0.1 points) How many gallons of beer are contained in a standard US beer barrel?

6. (4 points) What is the ASD $r_p/\Omega$ for a 1” A490-SC bolt in single shear, if it is a Class B surface, with no filler shims?

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1. (5 points). The axial force at Point A in the point-loaded parabolic arch, below is:
   a. 5.00 kips
   b. 5.50 kips
   c. 7.43 kips
   d. None of the above

Given: Reactions, as shown.

![Parabolic Arch Diagram](attachment:arch_diagram.png)

<table>
<thead>
<tr>
<th>10 kips</th>
<th>15 feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>A_x=5.5kips</td>
<td>C_x=5.5kips</td>
</tr>
<tr>
<td>A_y=5kips</td>
<td>C_y=5kips</td>
</tr>
<tr>
<td>40'</td>
<td></td>
</tr>
</tbody>
</table>

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Problems 2, 3, 4, and 5 refer to the building, below, which has a story height of 30’ and all column lines are 40’ apart. The building is subjected to 20 psf wind pressure, directed from East to West. All connections are simple, non-moment-resisting. The roof acts as a diaphragm. The exterior wall consists of the stud-framing, spanning from a foundation wall to the roof diaphragm, as shown along column line C, between lines 2 and 3, only, for clarity.

2. (3 points). TRUE or FALSE. Column D is considered unbraced.

3. (3 points). TRUE or FALSE. Column D receives zero axial force, due to the wind loading.
4. (9 points). Specify whether each brace is in Tension, Compression, or Zero Force, for the given wind direction.

<table>
<thead>
<tr>
<th>Brace</th>
<th>Tension</th>
<th>Compression</th>
<th>Zero Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brace A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brace B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brace C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. (20 points). Determine the magnitude of axial force in Brace B for the given wind direction.

FINAL ANSWER:

Axial force in Brace B: __________ kips
6. (30 points). Determine if the A992 W8x31 column is adequate per AISC Specifications, using ASD, and report \( P_n/\Omega \)

Given: The W8x31 column supports the W21x55, as shown. The W21x55 beam supports the 90 kip live load, as shown. The beam is supported by a pinned support at point C and by the pinned connection to the column at point B. The column has a fixed support at point A. It is known that the horizontal reaction components at A and C are zero. It is known that the moment reaction at A is zero.

**FINAL ANSWERS:**

Applied Load, \( P: \) _______ kips

Allowable Load \( P_n/\Omega: \) _______ kips
7. (30 points). The parabolic arch shown is subjected to a distributed load of 1 kip/ft, while composed of stones with a 10"x10" cross-section. This traditional masonry arch is considered to have infinite compressive strength, but zero tensile strength.

Determine:

a. The maximum normal stress in the arch.

b. The angle the arch makes with respect to the horizontal, at Point A.

**Final Answers:**

a). $\sigma_{\text{max}} = \underline{\text{ksi}}$

b). $\theta = \underline{\text{degrees}}$