Name: _____________________________

CE 311 Exam 2
September 26, 2012

You are allowed to have 1 page of your own notes, the AISC manual, and a calculator.

Bonus Questions (0.1 points, each)
1. (Fill in the blanks) Vince Lombardi once said, “Some people try to find things in this game that don't exist; but football is only two things - ___________________ and _____________________.

2. Through 15. Match the athlete to his number:

   Babe Ruth _____ 2
   Brett Favre _____ 3
   Derek Jeter _____ 4
   Jackie Robinson_____ 10
   Jerry Rice _____ 12
   Jimmy Johnson_____ 18
   Lawrence Taylor_____ 23
   Michael Jordan_____ 42
   Pele _____ 43
   Peyton Manning_____ 48
   Ray Lewis_____ 52
   Richard Petty_____ 56
   Tom Brady_____ 80
   Wayne Gretzky_____ 99
1. (2 points) TRUE or FALSE. Braces are designed as axially-loaded two-force members.

2. (2 points) TRUE or FALSE. The ASD method will lead to more conservative (larger, safer) member selection than LRFD when live loads are relatively high and dead loads are relatively low.

3. (4 points) For the plane shown, what is the theoretical K value for column AB? Given: Fixed base (foundation), rigid (moment-resisting) column-girder connections. Girder is W16x26. Column is considered to have infinite EIx.

![Diagram of column AB](image)

4. (4 points) For the plane shown, what is the theoretical K value for column AB? Given: W12x40 columns, W24x103 girder, pinned base (foundation), simple (non-moment-resisting) column-girder connections.

![Diagram of column AB](image)

5. (4 points). Matching. Match the ASD or LRFD term to the correct symbol for it.

<table>
<thead>
<tr>
<th>Term</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowable Load or Allowable Force</td>
<td>A. ( P_n )</td>
</tr>
<tr>
<td>Design Strength</td>
<td>B. ( \frac{P_n}{\Omega} )</td>
</tr>
<tr>
<td>Factored Load or Factored Force</td>
<td>C. P or ( P_n )</td>
</tr>
<tr>
<td>Applied Load</td>
<td>D. ( \phi P_n )</td>
</tr>
</tbody>
</table>

6. (4 points) Given: it is known that the column you are considering has \( \frac{P_n}{\Omega} = 205 \text{ kips} \), applied axial loads consist of 10 kips of dead load and 190 kips of live load. Is the column safe, per LRFD?
The following problems refer Building One shown below (five views are shown, for clarity)

View 1: Wall Studs Shown. Roof shown. Lower floor slabs and fill beams omitted, for clarity

View 2: Wall Studs and fill beams omitted for clarity

View 3: Frame Elevation Along Column Line 1

View 4: Fill beams shown
7. (20 points). For Building One, determine the LRFD factored axial force $P_a$ on the column between the ground and 2nd floor at grid location B2.

**Building One - Loads:**

**Dead Loads:**
- **Roof:** consists of roof deck/roofing material = 12 psf, supported by W14x22 fill beams and W16x26 girders
- **2nd & 3rd Floor:** consists of a 5” thick reinforced concrete slab (unit weight = 150 pcf), supported by W16x26 fill beams and W18x35 girders.
  
  For load estimation, assume that all columns weigh 50 plf.

**Live Loads:**
- **Roof Live Load:** 20 psf
- **2nd & 3rd Floor Live Load:** 100 psf (assume live load reduction not applicable)

**Snow Load:** 10 psf (location: southern Virginia)

**Wind Load:** “ultimate wind pressure” is 33.3 psf. For ASD problems, the load factor is 0.6, leading to an ASD wind pressure of 20 psf. For this exam, assume the wind is blowing from South to North.
8. (15 points). For Building One, determine the ASD maximum applied moment for a typical interior fill beam on the 2nd floor.

9. (10 points). For Building One, with wind blowing from South to North, report the horizontal base reactions for grid locations B1, C1, and D1. Use ASD.

Answers:

<table>
<thead>
<tr>
<th>Grid Location</th>
<th>Horizontal Base Reaction (kips)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td></td>
</tr>
</tbody>
</table>
**Tower Structure:** The following problem refers to the tower structure below. The tower is constructed with W12x40 A992 column shapes. All horizontal girder elements shown are W16x26 shapes, oriented such that their strong-axis resists bending due to gravity. All column-girder connections are rigid (moment-resisting). The bases are pinned. No bracing is present, but each level in the tower is assumed have diaphragms (not shown for clarity). The columns are oriented as shown in the plan view.
10. (35 points) Referring to the previous tower, determine the LRFD design strength $\phi P_n$ for the W12x40 A992 ($F_y = 50$ ksi) columns, based on the controlling slenderness.