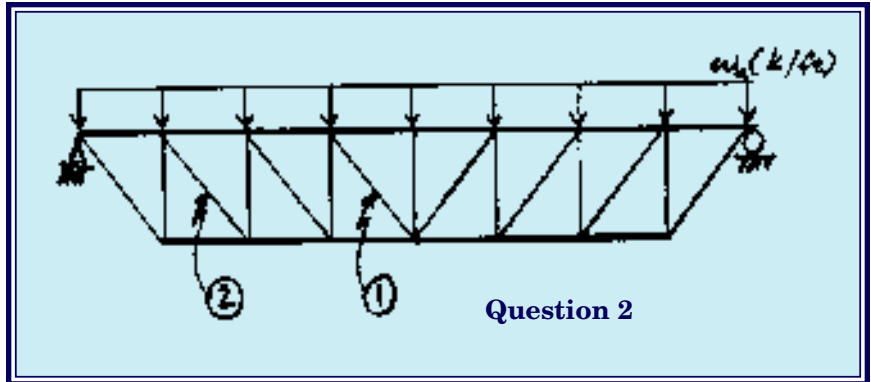


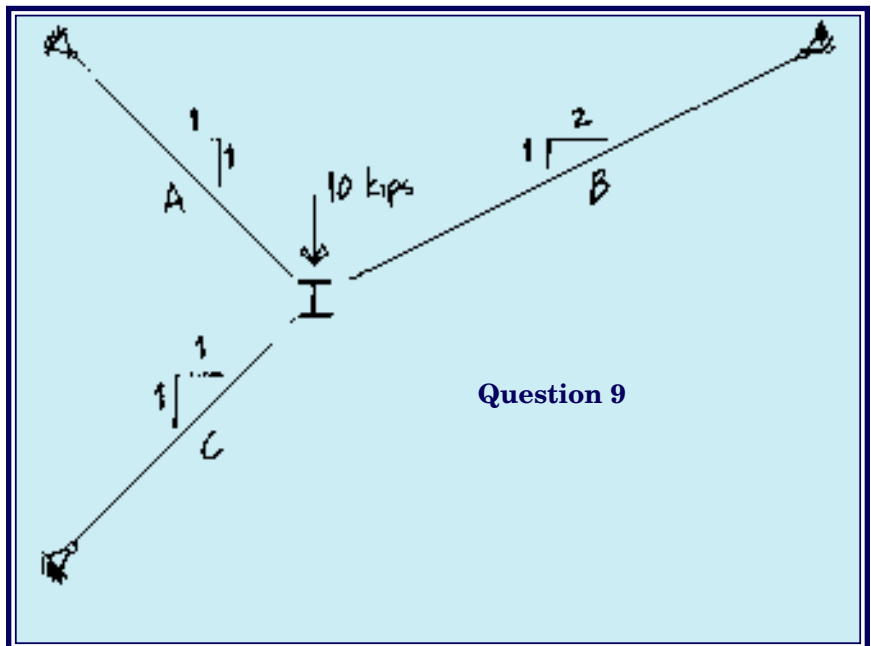
# STEEL QUIZ

**S**TEEL QUIZ, A MONTHLY FEATURE IN *MODERN STEEL CONSTRUCTION*, allows you to test your knowledge of steel design and construction. Unless otherwise noted, all answers can be found in the *LRFD Manual of Steel Construction*. To receive a free catalog of AISC publications, circle #10 on the reader service card in the back of this magazine.



## QUESTIONS:

- What is the heaviest W-shape produced domestically?
- In the sketch at right (top), which diagonal carries more load, 1 or 2?
- An ASTM A325 bolt is subjected to a tension load that is gradually increased until failure. Which of the following descriptions best fits the failed bolt?
  - the threads have stripped, causing the bolt and nut to separate
  - the unthreaded bolt shank is necked down and fractured near its mid-length
  - the threaded portion of the shank between the nut and thread runout is elongated and fractured
  - the unthreaded bolt shank is fractured near the juncture of the bolt head and shank
- A welder is observed and is not wearing a welding helmet. Which of the following welding processes is most likely being used?
  - flux-cored arc welding (FCAW)
  - submerged arc welding (SAW)
  - gas metal arc welding (GMAW)
  - shielded metal arc welding (SMAW)
  - none of the above
- ASTM A6 permits an as-rolled out-of-straightness equal to one one-thousandth of the length of the member. The designer must therefore consider this initial curvature when calculating compressive strength, True or False?



- Fire protection can be specified assuming that the member is either restrained or unrestrained. What is the difference between these assumptions?
- Name three methods for setting a column base to proper elevation.
- For a reinforced-concrete-encased W-shape column, what is the minimum clear cover required?
- Three cables restrain a column top for the 10-kip force as illustrated in the sketch above. Assuming the cables are initially taut and incline at 45 degrees with respect to the horizontal, what is the force in each cable?
- What load condition induces stress without strain? What load condition induces strain without stress?

**Send your ideas for Steel Quiz Questions & Answers to Charlie Carter, AISC, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001; fax: 312/670-5403.**

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## Answers:

1. A W14x398 is the heaviest domestically produced W-shape; a W40x397 runs a close second. Both are produced by Nucor-Yamato Steel Company. Non-domestic producers such as TradeARBED and British Steel produce columns up to W14x730; TradeARBED produces beams up to W40x593.
2. The load will be greater in diagonal 2.
3. c. This is illustrated in *Guide to Design Criteria for Bolted and Riveted Joints*. High-strength bolts subjected to tension fail in the threaded portion of the shank. Accordingly, a reduction for threading is incorporated into the tensile design strengths listed in the AISC Specification, which is then used with the nominal bolt area.
4. b. In the SAW process, the arc and molten weld metal are submerged beneath a layer of flux. Therefore, a welding helmet (eye protection from the arc) is not required.
5. False. This initial member curvature is already assumed in the AISC Specification.
6. In fire protection, the terms restrained and unrestrained refer to the resistance the surrounding system (e.g., the floor diaphragm) provides against thermal expansion of an element or elements subjected to fire. Expansion due to thermal loads is resisted for a restrained member but not resisted for an unrestrained member. Most typical steel construction can be considered to be restrained, which requires less fire protection; refer to ASTM E119 Appendix X3.
7. The use of a leveling plate, leveling nuts, and shim stacks are three alternatives. These and other methods are discussed in greater detail in the AISC *LRFD Manual of Steel Construction*, beginning on page 11-54.
8. From LRFD Specification Section I2.1(2), 1½ in. of clear cover is required outside of both transverse and longitudinal reinforcement.
9. The forces in cables A, B, and C are 13.3 kips, 8.16 kips, and 0 kips (cables can't resist compression), respectively. These correspond to lateral forces in a common horizontal plane at the column top of 9.43 kips, 5.77 kips, and 0 kips, respectively.
10. Stress without strain would result in a member that is subjected to a uniform temperature change while completely restrained from expansion or contraction. Strain without stress would result in a member that is subjected to a uniform temperature change while allowed to freely expand or contract. *Special thanks to Dr. Thomas M. Murray of Virginia Tech for contributing this question and answer.*