CS 444 - Quiz 4 Review Suggestions - Spring 2015

last modified: 2015-04-28

- You are responsible for material covered in class sessions and individual assignments; but, here's a quick overview of especially important material related to this upcoming quiz.

- You are permitted to bring into the quiz a single piece of paper (8.5" by 11") on which you have handwritten whatever you wish on one or both sides. This paper must include your name, it must be handwritten by you, and it will not be returned.
  - Other than this piece of paper, the quiz is closed-note, closed-book, and closed-computer.

- This is a quiz on material since Behavior-based robotics, up to and including balancing.
  - You are expected to still follow Java conventions and class coding standards in your quiz answers.

Course text - Chapter 9 - Building 101

- what is meant by a Lego design pattern?

- what is a caster wheel? what property does a caster wheel have? when might a caster wheel be useful on a robot? what placement of caster wheels on a robot helps caster wheels to work best?

- what are some common design goals, common desired properties? what are some means for attaining these goals or properties?

- be familiar with the general design advice in this chapter -- for example,
  - define functionality - determine the primary function of your robot-to-be and focus on that
  - start with the requirements and design around them
  - before making the design beautiful, make it work
  - use as few parts as possible -- optimize your design to use as few pieces as possible without compromising the essential features of your robot
  - the trade-off with speed is power -- since the specifications of the Lego NXT motors are the same, you can have speed or power, but not necessarily both

- why are two-wheeled robots one of the common "platforms" in robotics? what are often used with these to help maintain balance?
  - for a two-drive-wheeled robot with a caster wheel, where should you center the mass of your robot, for stability?

Course text - Chapter 18 - walking - shambler/Crawler.java

- what are some rules-of-thumb for robot stability?
  - (e.g., top-heavy vs. bottom-heavy? taller vs. shorter? likelihood to tip over during high acceleration vs. low acceleration? mass centered over the robot's base vs. centered elsewhere?)

- what is the center of gravity/center of mass?

- to maintain a robot's stability, you must keep its center of gravity within the center of a polygon defined by
what?

• what are some of the challenges of making a walking robot in general? what are some of the challenges of making a walking robot when one has motors that provide circular motion?

• (if we'd had the right pieces...) how is the shambler robot supposed to be able to change its direction?

**robot control**

• what is an example of simple control? what are some problems/issues/limitations of simple control?

• how does feedback control seek to improve on simple control?

• what is a control loop?

• what is a PID controller? What does PID stand for?
  – what, basically, are the three parts of the PID control algorithm?
  – what, basically, does the PID control algorithm seek to do?

• what were the trends discussed in robotic control in the 1960s/1970s? 1980s? the two branches since the 1990s?

• what are some classes of robot control architectures? how can each, basically, be characterized?

**balancing a robot - NXTway/Sejway**

• what is meant by dynamic balance?

• what type of sensor does the NXTway robot use for helping it to maintain its balance?

• what kind of control loop does the Sejway program use with that sensor to try to maintain the NXTway robot's balance?