CALIFORNIA INSTITUTE OF TECHNOLOGY
Control and Dynamical Systems

CS/EE/ME 75a

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Fall 2006

Homework Set #1

Issued: 2 Oct 06
Due: 9 Oct 06

Complete the problems below, trying to spend no more than the estimated time listed.

1. Read the DARPA Grand Challenge Rules, available at

   `http://wwww.darpa.mil/grandchallenge`

   Answer the following questions to the best of your ability (not all of them have complete answers):

   (a) What is the maximum length of time that the vehicle will have to be able to operate without intervention by the team members?

   (b) What vehicle subsystems must be shut off during a disable E-Stop signal? What other actions must be undertaken, if any?

   (c) What is the maximum distance between two waypoints and what is the minimum and maximum size of roads in which the vehicle must operate?

   (d) What is the format of the NQE test? How long will it last, what type of situations will be encountered, what type of obstacles are expected?

   Every student should read through the grand challenge rules; don't just ask your teammates for the answer or search for the spot that answers the specific question above. It's OK to cut and paste from the web site, as long as it is appropriately indicated in your homework. (Estimated time: 30 minutes)

2. Read the *Journal of Field Robotics* paper entitled "Alice: An Information-Rich Autonomous Vehicle for High-Speed Desert Navigation", available at

   `http://gc.caltech.edu/wiki/JFR05_Paper`

   The username and password will be given during class (ask a teammate if you missed class). Use the information provided there ot answer the following questions:

   (a) How much electrical power is available in Alice?

   (b) How many cameras were mounted on Alice in the 2005 race? How many LADARs?

   (c) What devices are used to estimate the current position, orientation of and pose of Alice? (Hint: the algorithm that performs this function is 'astate'.)

   (d) Which hardware and/or software failures were responsible for the crash at the end of the 2005 GCE?

   (Estimated time: 60 minutes.)

3. Read through the list of small projects at

   `http://gc.caltech.edu/wiki/Fall_2006_Small_Projects`

   Choose three projects that are in areas that interest you and evaluate the TRL (technology readiness level) for each project. As part of your evaluation, you should look through the wiki to see if any prior work has been performed that might increase the TRL level beyond 1.

   Note: The project list will be updated during the week, so you might want to check back to see if anything new has been added.