ME/CS 132(b): Final Project Guidelines
(Spring Quarter, 2017)

1 Final Project

The final projects can take many forms:

(1) an experimental project on the lab robots. For example, implement a sensor-based motion planner from ME/CS 132(a) and demonstrate the robot navigating around at least 2 obstacles to reach a distant goal. Or, join together a SLAM algorithm and a sensor-based motion planning scheme.

(2) simulation studies of an algorithm (e.g., implementing a voronoi graph planner in 2-D, and demonstrating the planner on some different environments).

(3) theoretical projects. For example, propose a new motion sensor-based planning algorithm and prove its completeness.

No matter what style of project you choose, it should integrate both *motion* and *sensing*–the two main topics from ME/CS 132(a) and ME/CS 132(b).

Below are some some short project descriptions to give you some ideas for your project. You need not be constrained by this list of projects–students can propose their own projects, subject to my approval. It is perfectly permissible for students to join together in teams for the final project. Of course, the final project output should be commensurate with the number of team members, and the same grade will be assigned to all team members.

2 Final Project Suggestions

Experimental Projects:

- Implement the "D-star" algorithm on the lab robots. This will require you to learn about the *occupancy grid* style of localization and mapping. Your project will then bring the occupancy grid and D-Star algorithm together
- Using the turtlebot robot to autonomously build a map of one floor of a building, using either the on-board RGB-D sensors, or the laser scanner. You will need to devise an algorithm to guide the robot's motions.
- Use the Intel drone and its on-board RGB-D camera to map a floor of a building.

- Implement and demonstrate on the lab robots one of the "bug" algorithms. The obstacles will be found by an on-board sensing suite.
- Develop and demonstrate a visual odometry system using monocular or stereo cameras.

"Sponsored Projects"

- **Earthquake Vibration Monitoring.** As discussed in class, develop a motion planning algorithm and vision-based corner sensing algorithm to allow a drone to fly to the top corner of a building and monitor the vibrations of the building during an earthquake.
- **Campus Mapping.** Using the Parrot drone, maximize the amount of campus that you can map during a single battery charge. You can use an existing SLAM/mapping algorithm. Your goal is to devise and demonsrate the "coverage algorithm."

3 Final Project Schedule

Preproposal: All students (or student teams) should prepare a 1-2 page "preproposal" by Wednesday, May 17 (5:00 pm). This preproposal will contain:

- A brief description of the proposed project.
- A summary of the likely approach that will be taken by the project investigator(s).
- A listing of the "project deliverables." That is, a description of how you propose to demonstrate and document the outcome of your project.

Due date: The final project is due at 5:00 p.m. on the last day of the spring quarter finals period. Your final project submission will consist of a project report that will include *at least* the following items:

- a short introduction that reviews the project's subject area and its goals.
- a description of the technical approaches taken to solve the project problems.
- A demonstration of the project's function (e.g., snapshots of graphical simulations, or plots of data taken from the robot).
- A "debriefing," which is a brief summary of what you would do differently if you had more time, or started all over again.

In creating your final report, you should aim for a document that could be read and understood by another student in the ME/CS 132 class.