Student Name: _____ Student ID # _____

OU Academic Integrity Pledge

On my honor I affirm that I have neither given nor received inappropriate aid in the completion of this exercise.

Signature: _____ Date: _____

Notes Regarding this Examination

Open Book(s) You may consult any printed textbooks in your immediate possession during the course of this examination.

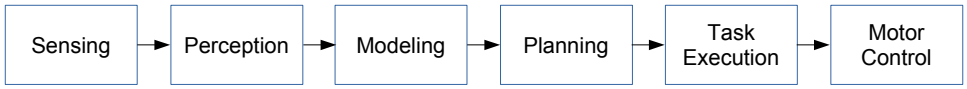
Open Notes You may consult any printed notes in your immediate possession during the course of this examination.

No Electronic Devices Permitted You may not use any electronic devices during the course of this examination, including but not limited to calculators, computers, and cellular phones. All electronic devices in the student's possession must be turned off and placed out of sight (for example, in the student's own pocket or backpack) for the duration of the examination.

Violations Copying another's work, or possession of electronic computing or communication devices in the testing area, is cheating and grounds for penalties in accordance with school policies.

Question 1: Deliberative Robotics (15 points)

Consider the following model for carrying out deliberation in a robot.



Explain one way in which Turnip 1 (from the paper by Mowforth and Grant) carried out an activity corresponding to each of the following modules.

A. Sensing

B. Perception

C. Modeling

D. Planning

E. Task Execution

Question 2: Reactive Robotics (10 points)

A. **Explain** one substantial reason the reactive robotics paradigm was *initially* viewed by many in the intelligent robotics community as *successful*.

B. **Explain** one substantial reason the reactive robotics paradigm was *eventually* viewed by most in the intelligent robotics community as *unsuccessful*.

Question 3: Deliberation and Reaction (10 points)

Consider the Subsumption architecture as proposed by Brooks and the layered robot architecture proposed by Simmons, et al. for Xavier.

A. **Explain** one substantial *similarity* between these architectures.

B. **Explain** one substantial *difference* between these architectures.

Question 4: Robot Sensing (10 points)

Select a robot sensor.

A. List the sensor you have selected.

B. **Explain** whether that sensor is *active*, *passive*, both, or neither.

C. **Explain** whether that sensor is *internal*, *external*, both, or neither.

D. **Explain** whether the readings from that sensor are *robot-centric*, *world-centric*, both, or neither.

Question 5: Robot Sensing, Revisited (15 points)

Consider using sensors such as the Kinect or Xtion for the task of constructing an occupancy grid map of an environment.

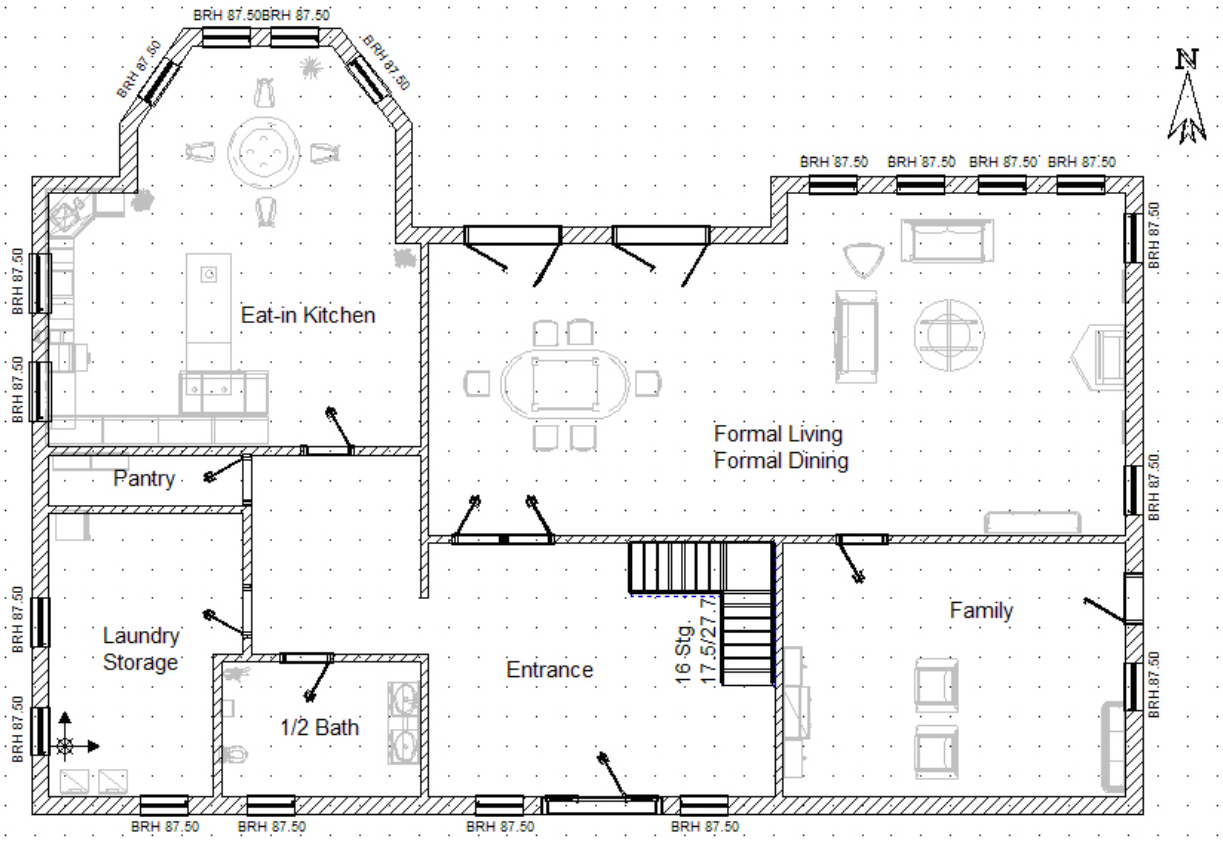
A. **Explain** one advantage such sensors have for this task over *sonar sensors*.

B. **Explain** one advantage such sensors have for this task over *laser rangefinders*.

C. **Explain** one advantage such sensors have for this task over *stereo cameras*.

Question 6: Metric Spatial Representation (30 points)

Consider the following floor plan. (Note that the entrance includes the area adjoining the 1/2 bath, laundry/storage, pantry, and eat-in kitchen. Ignore doors.)



From `https://en.wikipedia.org/wiki/File:Sample_Floorplan.jpg`.

Consider also uniform grid, quadtree, and vertex-based metric representations.

A. Select one room that could be most effectively represented using a *uniform grid* representation. State the room that you selected, draw the *occupancy grid* on the floor plan, and **explain** why a *uniform grid* representation is most effective for this room. (You may select your grid size.)

B. Select one room that could be most effected represented using a *quadtree* representation. State the room that you selected, draw the *quadtree occupancy map* on the floor plan, and **explain** why a *quadtree* representation is most effective for this room. (You may select your maximum and minimum grid sizes.)

C. Select one room that could be most effect's represented using a *vertex-based* representation. State the room that you selected, draw the *vertices* on the floor plan, and **explain** why a *vertex-based* representation is most effective for this room. (You do not need to label the vertices but do make them prominent enough to easily see.)

Question 7: Topological Navigation (10 points)

Consider again the floor plan from Question 6.

A. Give a purely topological navigation description to get someone from the eat-in kitchen to the family room.

B. Give a set of local control strategies that, if used in some sequence, could get someone with very limited sensing distance ($< 1m$) from the front door to the second floor of the house.