

Student Name: \_\_\_\_\_ Student ID # \_\_\_\_\_

**Question 1:** C-Space. 5 points.

Given the holonomic robot on the left and the C-Space environment shown on the right (to the same scale), can the robot get from point S to point G? **Explain your answer.**

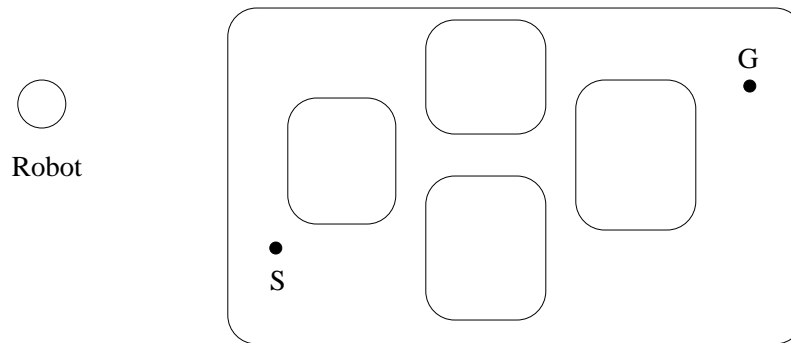


Figure 1: Robot (left) and C-Space environment (right).

**Question 2:** Hybrid Architectures. 20 points.

Both RCS and State-Hierarchy Architectures such as 3T explicitly consider time in terms of past, present, and future. Both are also explicitly divided into levels. Explain how the relationship of levels to past, present, and future differ between RCS and State-Hierarchy Architectures.

**Question 3:** Path Planning. 5 points.

Here is a partial path plan:

- From Highway 90, get on Highway 405 going north (towards Sacramento).
- Stay on Highway 405 for approximately 20 miles until you reach the 118 Freeway.
- Take 118 west (towards Simi Valley) for roughly 5 to 10 miles until you reach the Topanga Canyon exit.
- ...

Is this plan topological, metric, both, or neither? **Explain your answer.**

**Question 4:** Miller Time. 20 points.

Consider Robby, the robot designed for the Mars Rover Sample Return Mission.

A. Which advantages of teleoperation are found in the semi-autonomous mobility proposed for Robby?  
**Explain your answer.**

B. Which disadvantages of teleoperation are found in the semi-autonomous mobility proposed for Robby?  
**Explain your answer.**

C. Which advantages of autonomous operation are found in the semi-autonomous mobility proposed for Robby? **Explain your answer.**

D. Which disadvantages of autonomous operation are found in the semi-autonomous mobility proposed for Robby? **Explain your answer.**

**Question 5:** Metric Path Planning. 20 points.

Consider Generalized Voronoi Graphs and Point to Point path representations.

A. Which representation is better for planning paths to carry forty logs, one by one, from where a tree was cut down to a wood bin, in a big, open, flat yard that also contains two other trees (still standing) and a picnic table? **Explain your answer.**

B. Which representation is better for planning a path to move through a crowded library study room with many different tables, chairs, shelves, etc., to avoid? **Explain your answer.**

**Question 6:** Hybrid Architecture Styles. 20 points.

Which architecture style would you classify Jeeves (Thrun's robot from the 1996 AAAI Mobile Robot Competition) as having: Managerial, State-Hierarchical, Model-Oriented, or none of these? **Explain your answer.**

**Question 7:** Topological Path Planning. 10 points.

Paul and Sascha plan to use a relational path representation for their robot that is supposed to guide visitors to faculty offices and labs in the School of Computer Science, here at OU. Paul thinks the only nodes in the graph should be destinations (faculty offices and labs) and decision points (intersections). Sascha also wants to include additional nodes for other distinctive places, such as the vending machines, the CS bulletin board, and doors to other rooms (such as the room in which TA's hold office hours).

A. Give one advantage of Paul's method over Sascha's method. **Explain your answer.**

B. Give one advantage of Sascha's method over Paul's method. **Explain your answer.**