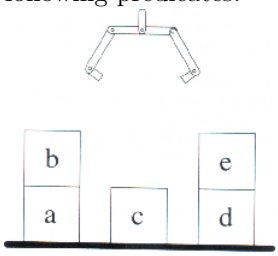
Mid-Term Sample Questions

The sample questions below should give you some idea what sort of questions can be expected on the mid-term exam. However, the number of questions posted below does not reflect the number of questions on the mid-term. Also, you can certainly expect questions on the mid-term which have no counterpart here.

1. You can expect questions on the material from assignments 1-3. Come up with variations on the problems posed in these assignments to challenge yourself with.

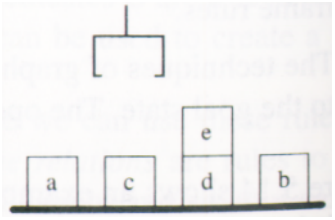
2. Describe the essential difference between model-based and behaviour-based approaches to robotics.

3. The blocks world environment pictured below can be described by the following predicates:



ontable(a), ontable(c), ontable(d), on(b, a), on(e, d), gripping(), clear(b), clear(c), clear(e)

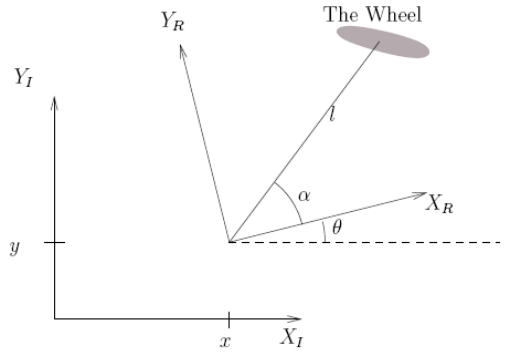
Describe the state of the following environment in the same manner:



4. A robot with pose [1 1 -pi/2]^{T} is compelled to move in the direction [1 1 0]^{T}. Express this direction of movement in the robot reference frame.

5. Describe the difference between proprioceptive and exteroceptive sensors.

6. Explain how a quadrature encoder achieves a two-fold increase in resolution over an incremental encoder.

7. A robot with a ring of 30 ultrasonic sensors applies each sensor in sequence and waits long enough for the pulse to return from a distance of 5 m. Assuming that the speed of sound is 0.3 m / ms, what is the bandwidth of this ring of sonar sensors?

8.
In the derivation of the rolling constraint presented in the notes we first determined $\dot{\boldsymbol{w}}_R$, the motion of the wheel in the robot reference frame. Derive $\dot{\boldsymbol{w}}_R$ as a 2-D vector expressed in terms of the components of $\dot{\boldsymbol{\xi}}_R$ (i.e., $\dot{x_R}$, $\dot{y_R}$, and $\dot{\theta}$). You must show all steps leading up to your final answer. It is suggested that you begin by considering the position of the wheel as pictured below.