COMPSCI 687 Pop Quiz 2

Name: _____

Instructions. This quiz is closed book and closed notes. You may not communicate with any other students or use any electronic devices. You have **5 minutes** to complete the quiz. As discussed in class, answers must be **perfect down to the symbol** to receive credit. Each question is graded as either correct or incorrect; there is no partial credit. **If your name is not legible, you will receive a 0 on the quiz.**

1. An MDP is a tuple (...). Fill in the "...", listing the symbols used in our definition of an MDP.
   $(\mathcal{S}, \mathcal{A}, p, R)$, $(\mathcal{S}, \mathcal{A}, p, R, d_0)$, $(\mathcal{S}, \mathcal{A}, p, R, \gamma)$, $(\mathcal{S}, \mathcal{A}, p, R, d_0, \gamma)$, or any of these with R replaced with d_R. That is, $\mathcal{S}$, $\mathcal{A}$, and p are necessary, as is either R or d_R (but not both), while d_0 and γ are optional.
   Note: We will accept all answers with or without a period at the end.

2. $\mathcal{S}$ is called the: state set
   Note: We will accept "State set" or "State Set" as well.

3. $\mathcal{A}$ is called the: action set
   Note: We will accept "Action set" or "Action Set" as well.

4. p is called the: transition function
   Note: We will accept "Transition function" or "Transition Function" as well.

5. Give the definition of p. Your answer should be two lines. The first specifies the input and output sets (e.g., $f : \mathcal{X} \to \mathcal{Y}$) and the second should specify the function values (e.g., $f(x) = \Pr(X = x)$). You may omit the quantifiers (e.g., $\forall x \in \mathcal{X}$).
   $p : \mathcal{S} \times \mathcal{A} \times \mathcal{S} \to [0, 1]$
   $p(s, a, s') = \Pr(S_{t+1} = s' | S_t = s, A_t = a)$
   Note: Quantifiers like $\forall s \in \mathcal{S}, \forall a \in \mathcal{A}, \forall s' \in \mathcal{S}$, will be ignored in grading. It's fine to use other notation like $\forall s, s' \in \mathcal{S}$, but we recommend omitting these quantifiers entirely. Note that Pr must be written, not just P.

6. R is called the: reward function
   Note: We will accept "Reward function" or "Reward Function" as well.

7. Give the definition of R. Your answer should be two lines. The first specifies the input and output sets (e.g., $f : \mathcal{X} \to \mathcal{Y}$) and the second should specify the function values (e.g., $f(x) = \Pr(X = x)$). You may omit the quantifiers (e.g., $\forall x \in \mathcal{X}$).
   $R : \mathcal{S} \times \mathcal{A} \to \mathbb{R}$
   $R(s, a) = \mathbf{E}[R_t | S_t = s, A_t = a]$
   Note: Quantifiers like $\forall s \in \mathcal{S}$ and $\forall a \in \mathcal{A}$ will be ignored in grading. You may write $\mathbf{E}$ or $\mathbb{E}$ for the expected value. You must include the square brackets in the expected value.

8. Give the definition of d_0. Your answer should be two lines. The first specifies the input and output sets (e.g., $f : \mathcal{X} \to \mathcal{Y}$) and the second should specify the function values (e.g., $f(x) = \Pr(X = x)$). You may omit the quantifiers (e.g., $\forall x \in \mathcal{X}$).
   $d_0 : \mathcal{S} \to [0, 1]$
   $d_0(s) = \Pr(S_0 = s)$
   Note: Quantifiers like $\forall s \in \mathcal{S}$ will be ignored in grading.