CSE 473, Spring 2018 – Project 4 **Name:**
Paul G. Allen School of Computer Science and Engineering

Project 4 - Question 8

This non-programming problem is part of Project 4. Please add your answers to this document and submit your completed document along with your solution to the Pac-Man project.

Suppose you are (attempting) to complete a marathon. You alternate between jogging and running. We will model your movement over time (in terms of seconds) as a Hidden Markov Model.

Let *j* be the state in which you are jogging and *r* be the state in which you are running.

At any time step, if you are running then there is a 60% chance that you will continue running at the next time step. At any time step, if you are jogging then there is a 20% chance you will continue jogging at the next time step.

Fill in the table with the transition probabilities as described above, where the row corresponds to X_{t+1} and the column to X_t.

	j	*r*
j	$P(X_{t+1}=j \mid X_t=j)=$	$P(X_{t+1}=j \mid X_t=r)=$
r	$P(X_{t+1}=r \mid X_t=j)=$	$P(X_{t+1}=r \mid X_t=r)=$

Now suppose there is evidence in the form of how close you are to other competitors in the marathon. If you are running then there is a 90% chance there is a person within 10 meters of you. If you are jogging there is a 30% chance there is a person within 10 meters of you. Let's denote the condition that there is a person within 10 meters of you as *m* and let's denote the complementary condition (that there is *not* a person within 10 meters of you) as $\neg m$.

Fill in the table with the conditional probabilities of the evidence based on the description above.

	J	*r*
m	$P(m \mid j)=$	$P(m \mid r)=$
$\neg m$	$P(\neg m \mid j)=$	$P(\neg m \mid r)=$

Assume there is a 50% chance you are initially jogging, $P(X_0=j)=0.5$. Compute the values for the passage of time for *j* and *r*, at *t*=1.

Now factor in the evidence that there is a person within 10 meters of you at *t*=1. Compute the beliefs $B(X_1=j)$ and $B(X_1=r)$.

Assume there is a 50% chance you are initially jogging, $P(X_0=j)=0.5$. What is the probability of producing the exact sequence *r, r, r*, *j*, *r*?

How would you change the transition probabilities so that you never change your movement (jogging/running) in between seconds? Provide the corresponding values.