# c166f19.quiz3.HMM- Requires Respondus LockDown Browser

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|---|---|---|
| **Due** No due date | **Points** 20 | **Questions** 10 |
| **Available** Nov 19 at 11am - Nov 19 at 12:30pm about 2 hours | | **Time Limit** None |

Requires Respondus LockDown Browser

This quiz was locked Nov 19 at 12:30pm.

## Attempt History

| | Attempt | Time | Score |
|---|---|---|---|
| **LATEST** | **Attempt 1** | 44 minutes | 10 out of 20 |

⚠ Correct answers are hidden.

Score for this quiz: **10** out of 20
Submitted Nov 19 at 11:48am
This attempt took 44 minutes.

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### Question 1                                                   2 / 2 pts

Given the following HMM:

| X | P(X) |
|---|---|
| 0 | 0.1 |
| 1 | 0.9 |

| X | P(X'=0\|X) | P(X'=1\|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | P(E=0\|X) | P(E=1\|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |

| 1 | 0.6 | 0.4 |
|---|-----|-----|

If no sensor data was received, calculate the stationary distribution, and provide the value to two decimal points for $P(X_\infty=0)$:

0.88

## Question 2

**2 / 2 pts**

Given the following HMM:

| X | P(X) |
|---|------|
| 0 | 0.1 |
| 1 | 0.9 |

| X | P(X'=0\|X) | P(X'=1\|X) |
|---|-----------|-----------|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | P(E=0\|X) | P(E=1\|X) |
|---|-----------|-----------|
| 0 | 0.9 | 0.1 |
| 1 | 0.6 | 0.4 |

If no sensor data was received, calculate the stationary distribution, and provide the value to two decimal points for $P(X_\infty=1)$:

0.11

## Question 3

**2 / 2 pts**

Given the following HMM:

| X | P($X_0$) |
|---|---|
| 0 | 0.1 |
| 1 | 0.9 |

| X | P(X'=0|X) | P(X'=1|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | P(E=0|X) | P(E=1|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.6 | 0.4 |

Calculate the following probability for time step 1 before seeing any evidence to 2 decimal places:

P($X_1$=0) =

0.81

## Question 4

2 / 2 pts

Given the following HMM:

| X | P($X_0$) |
|---|---|
| 0 | 0.1 |
| 1 | 0.9 |

| X | P(X'=0|X) | P(X'=1|X) |
|---|---|---|
| | | |

| | | |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | P(E=0\|X) | P(E=1\|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.6 | 0.4 |

Calculate the following probability for time step 1 before seeing any evidence to 2 decimal places:

$P(X_1=1) =$

0.19

## Question 5

**0 / 2 pts**

Given the following HMM:

| X | P( $X_0$ ) |
|---|---|
| 0 | 0.1 |
| 1 | 0.9 |

| X | P(X'=0\|X) | P(X'=1\|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | P(E=0\|X) | P(E=1\|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.6 | 0.4 |

If our sensor detects E=1 at time step 1, what is our belief vector for time step 1 to three decimal points:

$P(X_1=0) =$

> 0.297

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## Question 6                                                          0 / 2 pts

Given the following HMM:

| X | $P(x_0)$ |
|---|---|
| 0 | 0.1 |
| 1 | 0.9 |

| X | $P(X'=0|X)$ | $P(X'=1|X)$ |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | $P(E=0|X)$ | $P(E=1|X)$ |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.6 | 0.4 |

If our sensor detects E=1 at time step 1, what is our belief vector for time step 1 to three decimal points:

$P(X_1=1) =$

> 0.703

**Incorrect**

## Question 7                                0 / 2 pts

Given the following HMM and a random number generator that generates the
random sequence as listed in table, use the Particle Filtering Algorithm
process to update the following particles assuming that no evidence is seen,
then provide the new state value for Particle 1.

**HMM**

| X | P(X) |
|---|------|
| 0 | 0.1 |
| 1 | 0.9 |

| X | P(X'=0|X) | P(X'=1|X) |
|---|-----------|-----------|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | P(E=0|X) | P(E=1|X) |
|---|----------|----------|
| 0 | 0.9 | 0.1 |
| 1 | 0.6 | 0.4 |

**PARTICLES**

| Particle # | Particle Old Value | Random Number | Particle New Value |
|------------|-------------------|---------------|--------------------|
| 1 | 0 | 0.45 | |
| 2 | 1 | 0.10 | |
| 3 | 0 | 0.50 | |
| 4 | 0 | 0.95 | |
| 5 | 1 | 0.85 | |

Provide the new state value for Particle 1:

| 1 |

## Question 8

**2 / 2 pts**

Given the following HMM and a random number generator that generates the random sequence as listed in table, use the Particle Filtering Algorithm process to update the following particles assuming that no evidence is seen, then provide the new state value for Particle 1.

**HMM**

| X | P(X) |
|---|---|
| 0 | 0.1 |
| 1 | 0.9 |

| X | P(X'=0|X) | P(X'=1|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | P(E=0|X) | P(E=1|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.6 | 0.4 |

**PARTICLES**

| Particle # | Particle Old Value | Random Number | Particle New Value |
|---|---|---|---|
| 1 | 0 | 0.45 | |
| 2 | 1 | 0.10 | |
| 3 | 0 | 0.50 | |
| 4 | 0 | 0.95 | |
| 5 | 1 | 0.85 | |

Provide the new state value for Particle 5:

```
0
```

## Question 9

**0 / 2 pts**

Given the following HMM and a random number generator that generates the random sequence as listed in table, use the Particle Filtering Algorithm process to update the following particles given the evidence seen at time step 1 is E=1, then provide the new weight value for Particle 1 before resampling.

**HMM**

| X | P(X) |
|---|------|
| 0 | 0.1 |
| 1 | 0.9 |

| X | P(X'=0\|X) | P(X'=1\|X) |
|---|-----------|-----------|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | P(E=0\|X) | P(E=1\|X) |
|---|-----------|-----------|
| 0 | 0.9 | 0.1 |
| 1 | 0.6 | 0.4 |

**PARTICLES**

| Particle # | Particle Old Value | Random Number | Particle New Value | New Particle Weight |
|------------|--------------------|---------------|--------------------|---------------------|
| 1 | 0 | 0.45 | | |
| 2 | 1 | 0.10 | | |
| 3 | 0 | 0.50 | | |
| 4 | 0 | 0.95 | | |
| 5 | 1 | 0.85 | | |

Provide the weight for the new particle 1:

2

## Question 10

0 / 2 pts

Given the following HMM and a random number generator that generates the random sequence as listed in table, use the Particle Filtering Algorithm process to update the following particles given the evidence seen at time step 1 is E=1, then provide the new weight value for Particle 5 before resampling.

**HMM**

| X | P(X) |
|---|---|
| 0 | 0.1 |
| 1 | 0.9 |

| X | P(X'=0|X) | P(X'=1|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.8 | 0.2 |

| X | P(E=0|X) | P(E=1|X) |
|---|---|---|
| 0 | 0.9 | 0.1 |
| 1 | 0.6 | 0.4 |

**PARTICLES**

| Particle # | Particle Old Value | Random Number | Particle New Value | New Particle Weight |
|---|---|---|---|---|
| 1 | 0 | 0.45 | | |
| 2 | 1 | 0.10 | | |
| 3 | 0 | 0.50 | | |
| 4 | 0 | 0.95 | | |
| 5 | 1 | 0.85 | | |

Provide the weight for the new particle 5:

1

Quiz Score: **10** out of 20