# Homework 2

**Due** Oct 21 at 2:59am **Points** 100 **Questions** 10
**Available** until Oct 21 at 2:59am **Time Limit** 60 Minutes
**Allowed Attempts** 3

## Instructions

We use the conventions in the QBook101.

The default programming language for coding is Python. You may write pieces of code during this exercise.

When there are two or more correct answers, you must pick all and only the correct answers.

Take the Quiz Again

## Attempt History

| | Attempt | Time | Score |
|---|---|---|---|
| KEPT | Attempt 2 | 6 minutes | 80 out of 100 |
| LATEST | Attempt 2 | 6 minutes | 80 out of 100 |
| | Attempt 1 | 19 minutes | 50 out of 100 |

**Last Attempt Details:**

| | |
|---|---|
| **Time:** | 6 minutes |
| **Current Score:** | 80 out of 100 |
| **Kept Score:** | 80 out of 100 |

2 Attempts so far
View Previous Attempts
1 More Attempt available

Take the Quiz Again

(Will keep the highest of all your scores)

Correct answers are hidden.

Score for this attempt: **80** out of 100
Submitted Oct 7 at 10:14pm
This attempt took 6 minutes.

Incorrect

### Question 1

0 / 10 pts

Which one(s) of the following operators are stochastic?

- [x] $\begin{pmatrix} -\frac{1}{3} & \frac{2}{3} \\ \frac{2}{3} & \frac{1}{3} \end{pmatrix}$
- [ ] $\begin{pmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix}$
- [ ] $\begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{pmatrix}$
- [x] $\begin{pmatrix} \frac{1}{3} & \frac{2}{3} \\ \frac{2}{3} & \frac{1}{3} \end{pmatrix}$

## Question 2

10 / 10 pts

You are given a classical biased coin landing on Tails with probability 0.4.

The coin is flipped for 1000 times.

Which one is the most likely outcome compared to the others?

- (●) Heads: 585 Tails: 415
- ( ) Heads: 102 Tails: 898
- ( ) Heads: 203 Tails: 797
- ( ) Heads: 500 Tails: 500

## Question 3

10 / 10 pts

Given a probabilistic system of two bits and a operator,

$$\begin{pmatrix} 0.10 & 0.20 & 0.30 & 0.40 \\ 0.35 & 0.25 & 0.15 & 0.05 \\ 0.05 & 0.15 & 0.25 & 0.35 \\ 0.50 & 0.40 & 0.30 & 0.20 \end{pmatrix},$$

what is the probability of going from state $\lceil 01 \rfloor$ to state $\lceil 10 \rfloor$ ?

- ( ) 0.2
- ( ) 0.05
- (●) 0.15
- ( ) 0.25

## Question 4

10 / 10 pts

Each row sum of a probabilistic operator adds up to 1.

- (●) False
- ( ) True

## Question 5

10 / 10 pts

We combine two probabilistic bits ($b_1 \otimes b_2$ where

the first bit ($b_1$) is in state $\begin{pmatrix} \frac{1}{5} \\ \\ \frac{4}{5} \end{pmatrix}$ and the second bit ($b_2$) is in state $\begin{pmatrix} \frac{2}{3} \\ \\ \frac{1}{3} \end{pmatrix}$.

What is the probability of the combined system being in state $\lceil 10 \rfloor$ ?

- $\frac{4}{15}$
- $\frac{2}{15}$
- $\frac{8}{15}$
- $\frac{1}{15}$

## Question 6

10 / 10 pts

What is the dimension of the vector representing a system with 2 coins?

- 16
- 8
- 2
- 4

Incorrect

## Question 7

0 / 10 pts

If we want to simulate a biased coin landing on tails with probability 0.4, what should be the value of P in the following code?

```
from random import randrange
heads = tails = 0
for i in range(1000):
    if randrange(100) <= P:
        tails = tails + 1
    else:
        heads = heads + 1
print(heads,tails)
```

- 39
- 42
- 41
- 40

## Question 8

10 / 10 pts

In the fictional site called "Zone" (Stalker, 1979 film):

- if today is sunny, the probability that tomorrow is sunny is 0.2,
- if today is sunny, the probability that tomorrow is rainy is 0.8,
- if today is rainy, the probability that tomorrow is sunny is 0.4, and
- if today is rainy, the probability that tomorrow is rainy is 0.6.

Since there are only two states of weather, we can represent the daily change as a probabilistic operator.

Which one of the following can be this probabilistic operator?

- $\begin{pmatrix} 0.2 & 0.8 \\ 0.4 & 0.6 \end{pmatrix}$
- $\begin{pmatrix} 0.6 & 0.8 \\ 0.4 & 0.2 \end{pmatrix}$
- $\begin{pmatrix} 0.4 & 0.6 \\ 0.8 & 0.2 \end{pmatrix}$
- $\begin{pmatrix} 0.4 & 0.2 \\ 0.8 & 0.6 \end{pmatrix}$

## Question 9

10 / 10 pts

The following code prints a randomly picked probabilistic state:

```
from random import randrange
a = b = c = d = randrange(100)
sum = a + b + c + d
state = [a/sum,b/sum,c/sum,d/sum]
print(state)
```

- True
- False

## Question 10

10 / 10 pts

```
from random import randrange
heads = tails = 0
for i in range(100):
    if randrange(4)==randrange(4): heads = heads + 1
    else: tails = tails + 1
print(heads)
```

Which one is the most likely outcome?

- 71

- 4
- 98
- 27
- 12

Quiz Score: **80** out of 100

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