Congratulations! You passed!

TO PASS 70% or higher

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GRADE
100%

Week 2 Practice Quiz

TOTAL POINTS 8

1. You are given a unigram language model θ distributed over a vocabulary set V composed of **only** 4 words: “the”, “machine”, “learning”, and “data”. The distribution of $\theta$is given in the table below: **1 / 1 point**

w	$P(w\|\theta)$
machine	0.1
learning	0.2
data	0.3
the	0.4

$P(\text{“machine learning”}|\theta) =$

- 0.2
- 0.004
- 0.02
- 0.3

Correct

Since in a unigram language model words are assumed to be generated independently, we have $P(\text{“machine learning”}|\theta) = P(\text{“machine”}|\theta)P(\text{“learning”}|\theta) = 0.1 * 0.2 = 0.02$

2. Assume the same unigram language model as in Question 1. Then, $P(\text{“learning machine”}|\theta) =$ **1 / 1 point**

- 0.3

- (●) 0.02
- ( ) 0.004
- ( ) 0.2

✓ **Correct**

Due to the independence assumption, the word order does not matter when generating text based on a unigram language model. Thus, the answer is the same as that of Question 1.

3. Assume the same unigram language model as in Question 1. Then, $P(\text{“learning machine learning”}|\theta) =$ **1 / 1 point**

- ( ) 0.02
- (●) 0.004
- ( ) 0.3
- ( ) 0.2

✓ **Correct**

0.2 * 0.1 * 0.2

4. Assume that words are being generated by a mixture of two unigram language models, θ_1 and θ_2, where $P(\theta_1) = 0.5$ and $P(\theta_2) = 0.5$. The distributions of the two models are given in the table below: **1 / 1 point**

w	$P(w\|\theta_1)$	$P(w\|\theta_2)$
the	0.4	0.15
and	0.4	0.15
genes	0.05	0.3
biology	0.15	0.4

Then $P(\text{“biology”}) =$

- 0.175
- 0.15
- 0.55
- 0.275

Correct

$P(\text{“biology”}) = P(\text{“biology”}|\theta_1)P(\theta_1) + P(\text{“biology”}|\theta_2)P(\theta_2) = 0.15 * 0.5 + 0.4 * 0.5 = 0.275$

5. Assume the same given as in Question 4. Then $P(\text{“the biology”}) =$ **1 / 1 point**

- 0.275
- 0.275625
- 1
- 0.075625

Correct

$P(\text{“the biology”}) = (P(\text{“the”}|\theta_1)P(\theta_1) + P(\text{“the”}|\theta_2)P(\theta_2))(P(\text{“biology”}|\theta_1)P(\theta_1) + P(\text{“biology”}|\theta_2)P(\theta_2)) = 0.075625$

6. True or false? A random variable X with P(X=1)=1 achieves the minimum possible entropy. **1 / 1 point**

- False
- True

Correct

This is a deterministic variable with H(X) = 0, which is the lowest possible value for entropy.

7. True or false? The outcome of an unbiased coin is easier to predict than the outcome of a biased coin. **1 / 1 point**

- ○ True
- ◉ False

✓ **Correct**

It's harder to predict. An extreme case is for a coin with only head, after observing it's first few outcome, one can easily determine the next outcomes given it is known that the coin has only one face.

8. Which of the following is not true? **1 / 1 point**

- ◉ If H(X) = H(Y), then X and Y follow the same distribution
- ○ If H(X|Y) = H(Y|X), then H(X) = H(Y)
- ○ I(X;Y) = I(Y;X)

✓ **Correct**

Counterexample for "If H(X) = H(Y) then X and Y follow the same distribution": Let P(X=1) = 0.9 and P(Y=1) = 0.1. Clearly, H(X) = H(Y), however, the distributions of the two random variables are different. "If H(X|Y) = H(Y|X) then H(X) = H(Y)" is always true because H(X)=I(X;Y)+H(X|Y) and H(Y)=I(X;Y)+H(Y|X).