

Create Rubric

18 points

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Q1

1 point

Rubric Settings

1. (1 point) Stringle uses the following color scheme, or assignment of colors to meanings:

- green for letters in the correct position,
- yellow for letters in the Stringle string, but in the incorrect position,
- gray for letters not in the Stringle string.

Suppose the game developers could have instead used any three colors from the set of seven colors {red, orange, yellow, green, blue, purple, gray}, so long as no color has multiple meanings. How many color schemes include the color purple?

- 15
- 30
- 90
- 120
- None of the above.

1 +1.0

Correct: $90 = 3 * 6 * 5$

2 +0.0

Incorrect

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Q2

1 point

Rubric Settings

2. (1 point) Suppose that every day, the Stringle string is chosen without replacement from among the set of all possible valid strings. What is the probability that DSCTEN was the Stringle string for one of the first 100 days after the game's release?

1 +1.0

Correct: $\frac{100}{26^6} = 100 \times \frac{P(26^6 - 1, 99)}{P(26^6, 100)} = 1 - \frac{P(26^5 - 1, 100)}{P(26^6, 100)}$

2 +0.0

Incorrect/Omitted

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Q3

1 point

[Rubric Settings](#)

3. (1 point) What is the probability of today's Stringle string having exactly one duplicate letter, like SYSTEM, BEFORE, or YELLOW?

- $\frac{P(26,5) * 5!}{26^6}$
- $\frac{C(26,5) * 5!}{26^6}$
- $\frac{C(6,2) * P(26,5)}{26^6}$
- $\frac{C(26,5)}{26^6}$
- None of the above.

1 +1.0

Correct: $\frac{C(6,2)*P(26,5)}{26^6}$

2 +0.0

Incorrect

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Q4

1 point

[Rubric Settings](#)

4. (1 point) What is the probability of today's Stringle string having at least one duplicate letter, like SYSTEM, GOOGLE, or WAHOOO?

1 +1.0

Correct: $1 - \frac{P(26,6)}{26^6}$

2 +0.0

Incorrect / Blank

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Q5

1 point

 Rubric Settings

5. (1 point) What is the probability that today's String string has the last three letters matching the first three letters, like BAMBAM or GOOGOO, if we know that the first letter matches the fourth letter?

- $\frac{1}{26^2}$
- $\frac{1}{26^3}$
- $\frac{P(26, 3)}{P(26, 5)}$
- $\frac{P(26, 3)}{26^6}$
- None of the above.

1 +1.0

Correct: $\frac{1}{26^2}$

2 +0.0

Incorrect

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Q6

1 point

 Rubric Settings

6. (1 point) How many possible String strings contain exactly three H's, like HAHAHA or SSSHHH?

- $C(6, 3) * 26^3$
- $C(6, 3) * 26^6$
- $C(6, 3)$
- 25^3
- None of the above.

1 +1.0

Correct: None of the above. Should be $C(6, 3) * 25^3$.

2 +0.0

Incorrect

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Q7

1 point

 Rubric Settings

7. (1 point) For this problem, we'll say that there are six vowels: A, E, I, O, U, and Y. Consider the following three events:

- A is the event that today's Stringle string starts with a vowel.
- B is the event that today's Stringle string starts with a letter in the first half of the alphabet (A through M, inclusive).
- C is the event that today's Stringle string does not start with a Z.

Which of the following is true?

- A and B are independent. A and B are conditionally independent given C.
- A and B are independent. A and B are conditionally dependent given C.
- A and B are dependent. A and B are conditionally independent given C.
- A and B are dependent. A and B are conditionally dependent given C.
- None of the above.

1 +1.0

Correct: A and B independent, conditionally dependent given C

2 +0.0

Incorrect

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Q8

1 point

 Rubric Settings

8. (1 point) For this problem, we'll say that there are six vowels: A, E, I, O, U, and Y. What is the probability that today's Stringle string satisfies at least one of the following conditions?

- starts with a vowel
- ends with a vowel
- first two letters are the same

1 +1.0

$$\frac{6}{26} + \frac{6}{26} + \frac{1}{26} - \frac{6}{26} * \frac{6}{26} - \frac{6}{26} * \frac{1}{26} - \frac{6}{26} * \frac{1}{26}$$
$$+ \frac{6}{26} * \frac{6}{26} * \frac{1}{26}$$

$$\text{Correct: } 1 - \frac{20}{26} * \frac{20}{26} * \frac{25}{26}$$

2 +0.0

Incorrect/Omitted

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Q9

1 point

 Rubric Settings

9. (1 point) Your first guess for today's Stringle has six distinct letters. There are 3^6 possible colored feedback sequences for this first guess, since each of the six letters could be colored one of three colors: green, yellow, or gray. How many of the 3^6 possible feedback sequences for your first guess include 2 green letters, 2 yellow letters, and 2 gray letters?

6!

1 +1.0

- $C(6,3)$
- $(C(6,2))^3$
- $C(6,2) * C(4,2)$
- None of the above.

Correct: $C(6, 2) * C(4, 2)$

2 +0.0

Incorrect

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Q10

1 point

 Rubric Settings

10. (1 point) Consider the following three events:

- A is the event that today's Stringle string has a duplicate letter.
- B is the event that today's Stringle string starts with a B .
- C is the event that today's Stringle string has the same first and last letter.

Which of the following is true?

- A and B are independent.
 A and C are independent.
 B and C are dependent.
- A and B are dependent.
 A and C are independent.
 B and C are independent.
- A and B are independent.
 A and C are dependent.
 B and C are dependent.
- A and B are dependent.
 A and C are dependent.
 B and C are independent.
- None of the above.

1 +1.0

Correct: None of the above. A and B are independent. A and C are dependent. B and C are independent.

2 +0.0

Incorrect

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Q11

1 point

 Rubric Settings

11. (1 point) Suppose your Stringle strategy is to guess a random six-letter string every time. That is, each guess you make is equally likely to be any six-letter string, and you don't incorporate the feedback from your prior guesses into subsequent guesses. You might even guess the same string twice!

With this (horrible) strategy, what is the probability that your Stringle score for today is 8?

1 +1.0

Correct: $\left(1 - \frac{1}{26^6}\right)^7 * \left(\frac{1}{26^6}\right)$

2 +0.0

Incorrect / Blank

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Q12

1 point

Rubric Settings

12. (1 point) Your competitive family keeps track of their Stringle scores in a spreadsheet, where each column represents a different date, and each person in the family records their scores in a different row. Suppose your family has 5 people, and you have kept track of Stringle scores for 50 days, so your spreadsheet has 5 rows and 50 columns. How many ways are there to organize the spreadsheet, if the rows can be in any order, but the columns must be in chronological order or reverse chronological order?

1 +1.0

Correct: $2^*5!$

2 +0.0

Incorrect / Blank

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Q13

1 point

Rubric Settings

13. (1 point) Suppose you apply k -means clustering to the data in your family's Stringle score spreadsheet by representing the entries in each column of the spreadsheet as a vector in \mathbb{R}^5 . If we run the algorithm with $k = 2$, which of the following is the best description of what the clusters represent?

- One cluster represents the Stringle strings that were easier to guess, and the other represents the Stringle strings that were harder to guess.
- One cluster represents the family members who are better Stringle players, and the other represents the family members who are not as good.
- One cluster represents the Stringle strings that had duplicated letters, and the other represents the Stringle strings that had distinct letters.
- One cluster represents the family members who play Stringle more often, and the other represents the family members who do not play as often.

1 +1.0

Correct: One cluster represents strings that were easier to guess, the other represents harder strings

2 +0.0

Incorrect

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Q14

1 point

 [Rubric Settings](#)

14. (1 point) You survey 250 Stringle players and ask them several questions about their Stringle-playing behavior, with the goal of figuring out how much they would be willing to pay if Stringle were to switch to a paid annual subscription. All of the questions are yes or no questions, except for

"What's the maximum amount you would pay for a year's subscription to Stringle?"

which has options \$0, \$10, or \$20. Of the 250 participants,

- 100 said they would pay \$0,
- 50 said they would pay \$10, and
- 100 said they would pay \$20.

The table below shows the survey questions and gives the number of people who answered yes to each question, broken down by how much they would pay for a subscription.

Question	Number of yes responses from those who would pay \$0 (among 100 people)	Number of yes responses from those who would pay \$10 (among 50 people)	Number of yes responses from those who would pay \$20 (among 100 people)
Do you play Stringle every day?	30	10	50
Do you share your Stringle results with friends or family?	40	20	40
Do you record your Stringle scores anywhere?	30	30	30
Have you ever recommended Stringle to someone you know?	40	40	80

Assume that each person answered each question on the survey. For example, of the 100 people who said they would pay \$0 for Stringle, 30 said "Yes" to the question *Do you play Stringle every day?*, and the other 70 said "No".

You will use the results of this survey to try to predict how much a person is willing to pay based on their answers to the four questions listed in the table above, using a naive Bayes classifier (without smoothing).

What would your classifier predict for someone who answers the survey questions as follows:

- *Do you play Stringle every day?* "No"
- *Do you share your Stringle results with friends or family?* "Yes"
- *Do you record your Stringle scores anywhere?* "No"
- *Have you ever recommended Stringle to someone you know?* "No"

Hint: It's not necessary to do lots of arithmetic.

- This person would pay \$0 for a Stringle subscription.
- This person would pay \$10 for a Stringle subscription.
- This person would pay \$20 for a Stringle subscription.

1 +1.0

Correct: Person would pay \$0

2 +0.0

Incorrect

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Q15

1 point

 [Rubric Settings](#)

15. (1 point) This problem is a continuation of the previous problem, using the same survey results.

After making predictions for various individuals based on their answers to all four survey questions, you realize that in every case, regardless of how the person answered the survey questions, you could make the same prediction using only three of the four survey questions. For this data, which survey question can you safely remove, without changing the results of your naive Bayes classifier?

- Do you play Stringle every day?
- Do you share your Stringle results with friends or family?
- Do you record your Stringle scores anywhere?
- Have you ever recommended Stringle to someone you know?
- None of the above. Removing any question will change the results of the naive Bayes classifier.

1 +1.0

Correct: Do you share Stringle results with friends or family?

2 +0.0

Incorrect

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Q16

1 point

 [Rubric Settings](#)

16. (1 point) Stringle has become such a popular game that many spin-offs have been created. In a variant called Quadringle, players have to solve four different Stringle puzzles at the same time. We'll say that a Quadringle puzzle is determined by which four six-letter strings it includes, and the order of those four strings does not matter. How many Quadringle puzzles are possible?

- $(26^6)^4$
- $C(26^6, 4)$
- $P(26^6, 4)$
- $4^C(26, 6)$
- None of the above.

1 +1.0

Correct: $C(26^6, 4)$

2 +0.0

Incorrect

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Q17

1 point

 [Rubric Settings](#)

17. (1 point) In today's Quadringle puzzle, the four strings are all very similar:

DEALER, RELAYS, ALLOYS, and SALADS.

Suppose you pick one of these four strings at random, so that each has a $\frac{1}{4}$ probability of being chosen. Then you choose one letter of that word at random, such that each has a $\frac{1}{6}$ probability of being chosen.

It turns out that you picked an L. What is the probability that your L came from the word SALADS?

- $\frac{1}{24}$
- $\frac{1}{6}$
- $\frac{1}{5}$
- $\frac{1}{4}$
- None of the above.

1 +1.0

Correct: $\frac{1}{5}$

2 +0.0

Incorrect

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Q18

1 point

 Rubric Settings

18. (1 point) In today's Quadringle puzzle, the four strings are all very similar:

DEALER, RELAYS, ALLOYS, and SALADS.

Suppose you pick one of these four strings at random, so that each has a $\frac{1}{4}$ probability of being chosen. Then you choose one letter of that word at random, such that each **distinct** letter in the word has an equal probability of being chosen.

It turns out that you picked an E. What is the probability that your E came from the word DEALER?

- $\frac{1}{24}$
- $\frac{1}{6}$
- $\frac{1}{5}$
- $\frac{1}{4}$
- None of the above.

1 +1.0

Correct: None of the above. Should be $\frac{6}{11}$.

2 +0.0

Incorrect

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