CISC 7700X Midterm Exam

Pick the best answer that fits the question. Not all of the answers may be correct. If none of the answers fit, write your own answer.

1. (5 points) A *model* is:
   (a) A description.
   (b) A fact.
   (c) A data point.
   (d) All of the above.

2. (5 points) Both mean and median measure:
   (a) The spread of the data.
   (b) The slope of the data.
   (c) The central tendency of the data.
   (d) The gradient of the data.

3. (5 points) Both standard deviation and interquartile range measure:
   (a) The central tendency of the data.
   (b) The slope of the data.
   (c) The gradient of the data.
   (d) The spread of the data.

4. (5 points) If $P(x, y) = P(x)P(y)$ then
   (a) x is more likely than y.
   (b) x is causes y.
   (c) x and y are independent.
   (d) x and y are not independent.
   (e) None of the above, answer is:

5. (5 points) The process of computing $P(x)$ from $P(x|y)P(y)$ is called
   (a) Bootstrapping
   (b) Generalizing
   (c) Marginalizing
   (d) Specifizing

6. (5 points) Suppose we have $P(A, B, C, D, E, F, G, H, I, J, K)$, where each of the $A, \ldots, K$ has values from 1 to 100. We would like to find $P(K)$. How many loops would be required to calculate that?
   (e) Answer is:

7. (5 points) Fair coin flipping game: We start with \$1. Heads we win 50%, tails we lose 50%. After 3 rounds, with a fair coin, the *median* value we will have:

   (e) Answer is:

8. (5 points) Fair coin flipping game: We start with \$1. Heads we win 50%, tails we lose 50%. After 3 rounds, with a fair coin, the *geometric mean* value we will have:

   (e) Answer is:

9. (5 points) Fair coin flipping game: We start with \$1. Heads we win 50%, tails we lose 50%. After 3 rounds, with a fair coin, the *arithmetic mean* value we will have:

   (e) Answer is:

10. (5 points) In Bayes rule: $P(x|y) = P(y|x)P(x)/P(y)$, the $P(y|x)$ is:

    (a) The prior probability.
    (b) The posterior probability.
    (c) The likelihood.
    (d) The conditional probability of y given x.

11. (5 points) Conditional probability $P(y|x)$ differs from likelihood $P(y|x)$:

    (a) They're both the same.
    (b) They both sum to 1.
    (c) Probability $P(y|x)$ is a function of y, while likelihood $P(y|x)$ is a function of x.
    (d) Likelihood tells us the probability of y given x.

12. (5 points) Which one of these is correct?

    (a) $P(A|B) = \frac{P(B|A)P(A)}{\sum P(A,B)}$
    (b) $P(A|B) = P(B|A)P(A)P(B)$
    (c) $P(A|B) = P(A,B)/P(B|A)$
    (d) $P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A)+P(B|-A)P(-A)}$

13. (5 points) Which one of these is correct?

    (a) $P(A,B,C) = P(A|B)P(B|C)P(C)$
    (b) $P(A,B,C) = P(A|B,C)P(B|C)P(C)$
    (c) $P(A,B,C) = P(A|C)P(C|B)P(B)$
    (d) $P(A,B,C) = P(A|B)P(A|C)P(B)P(C)$

14. (5 points) If $P(x|y) = P(x,y)/P(y)$ then

(a) x is more likely after y.

(b) y is causes x.

(c) x and y are independent.

(d) x and y are not independent.

(e) None of the above, answer is:

15. (5 points) About 10% of snakes are venomous. Of the venomous snakes, 60% have yellow spots, while only 10% of non-venomous snakes have yellow spots. We see a snake with yellow spots, use Bayes rule to find probability it is venomous.

Answer is :

16. (5 points) Continuing from previous question. Of the venomous snakes, 1% live in North America, while only 5% of non-venomous snakes live in North America. We spot a snake in upstate NY, use Bayes rule to find probability it is venomous.

Answer is :

17. (5 points) Continuing from previous question, write out the bayes rule formula to determine probability of a yellow-dotted snake in upstate NY is venomous. Can we calculate that probability? Why?

Answer is :

18. (5 points) Continuing from previous question, write out the naive bayes rule formula to determine probability of a yellow-dotted snake in upstate NY is venomous. Calculate the probability.

Answer is :

19. (5 points) Given a sample of N data points, we discover that we can fit two models, a line: $y = w_0 + w_1 x$ and a polynomial:

$$y = w_0 + w_1 x + w_2 x^2 + w_3 x^3 + w_4 x^4 + w_5 x^5$$

The polynomial fits our training dataset 'better'. Which is true:

(a) We'd expect the line to have higher variance, but lower bias.

(b) We'd expect both to have equivalent bias and variance.

(c) We'd expect the line to have lower variance, but higher bias.

(d) We'd expect the polynomial to perform better on other samples.