

Name:

Section:

STAT 113 – Midterm 1

1. On questions 1a-f: [2pts] for the correct choice; [0pts] for no choice; [-1pt] for a wrong choice. If more than one choice is correct, any correct choice is fine.

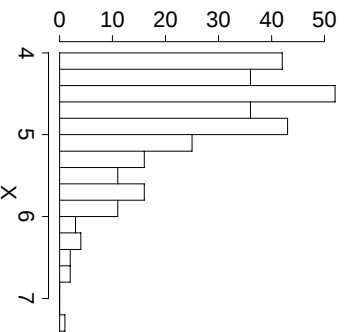
1a. $P(A \cap B \cap C) =$ (circle the correct answer)

- (A) $P(A|B)P(A|C)P(B \cap C)$ (B) $P(A|B \cap C)P(B|C)P(C)$
 (C) $P(A|B)P(B|C)P(C)$ (D) $P(A|B)P(B|C)P(C|A)$
 (E) none of the above are correct

1b. $P(A|B) =$ (circle the correct answer)

- (A) $\frac{P(A \cap B)}{P(A)}$ (B) $\frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|A^c)P(A^c)}$
 (C) $\frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|A^c)[1 - P(A)]}$ (D) $\frac{P(B \cap A)}{1 - P(B)}$
 (E) none of the above are correct

- 1c. Consider the following histogram of $n = 300$ measurements: Denote with $\bar{x}$ the sample mean, with Md the sample median, and with s^2 the sample variance. Which of the following statements is correct?



(circle the correct answer)

- (A) $\bar{x} > Md$, (B) $\bar{x} < Md$, (C) $\bar{x} = Md$.

- 1d. Let s^2 denote the sample variance of the data shown in the above histogram.

Which of the following statements is correct?

- (A) $s^2 < 4$ (B) $4 < s^2 < 10$ (C) $s^2 > 10$

- 1e. Peter is preparing for the final exam in his history of France course. The exam will consist of 5 essay questions selected at random from a list of 10 the professor has handed out in advance. Not exactly a Napoleon buff, Peter has only prepared eight of the questions. Let y denote the number of questions on the exam which Peter has prepared.

(circle the correct answer):

- (A) y is a binomial r.v. (B) y is a hypergeometric r.v.
 (C) y is a negative binomial r.v. (D) y is a Poisson r.v.
 (E) none of the above

- 1f. Assume someone circles at random a choice for question 1e. Let y denote the points. $E(y)$ is closest to (circle the number closest to the answer):

- (A) -1.2 (B) -1.00 (C) -0.8 (D) -0.6
 (E) -0.4 (F) -0.2 (G) 0.0 (H) 0.2

2. Businesses commonly project revenues under alternative economic scenarios. For a stylized example, inflation could be high or low and unemployment could be high or low. There are four possible scenarios, with the assumed probabilities:

Scenario	Inflation	Unemployment	Probability
1	high	high	0.20
2	high	low	0.20
3	low	high	0.36
4	low	low	0.24

Hint: Denote with A the event “high inflation”, and with B the event “high unemployment”.

2a [3pts] What is the probability of high inflation?

2b [4pts] What is the probability of high inflation if unemployment is high?

2c [3pts] Are inflation and unemployment independent (justify your answer)?

3. A family has two dogs (Rex and Rover) and a little boy (Russ). None of them is fond of the mailman. Given that they are outside, Rex and Rover have a 30% and a 40% chance, respectively, of biting the mailman. Russ, if he is outside, has a 15% chance of doing the same thing. Suppose only one of the three is outside when the mailman comes. Rex is outside 50% of the time, Rover 20% of the time and Russ 30% of the time.

3a [5pts] What is the probability the mailman will be bitten?

3b [5pts] *If* the mailman is bitten, what are the chances that Russ did it?

4. James Bond insists that his martinis be shaken, not stirred. A skeptical bartender tests Bond with 6 martinis (using six coin flips to determine which drinks to shake and which to stir). Bond errs on one and correctly identifies the other 5 before passing out. Denote with p the probability that Bond can tell the difference between shaken and stirred Martinis.
- 4a [3pts] If $p = 0.5$, what is the probability of guessing 5 or more Martinis correctly?
- 4b [3pts] Find the value of p such that guessing 5 out of 6 Martinis correctly is highest
(*justify your answer; just stating the answer is not sufficient*).
Hint: Instead of maximizing $p(5)$ it is easier to consider $\log p(5)$.
- 4c [2pts] Assume that instead of deciding initially to serve 6 Martinis, the bartender was serving Martinis until Bond guessed 5 correctly. Assuming $p = 0.5$, find the probability of erring once.
- 4d [2pts] Under the assumptions of 4c, find the value of p such that guessing 5 out of 6 Martinis correctly is highest
(*justify your answer; stating the answer only is not sufficient*).