Name _____

Student Number _____

STA 256 f2019 Test 1

Question	Value	Score
1	25	
2	25	
3 - 12	50	
Total = 100 Points		

1. (25 points) Suppose a baseball pitcher throws fastballs 70% of the time and curveballs 30% of the time. Suppose a batter hits a home run on 5% of all fastball pitches, and on 2% of all curveball pitches. Given that the batter hits a home run, what is the probability that it was a fastball? Show your work. Give the final answer to 3 decimal places. **Circle your answer**.

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2. (25 points) Let the events A and B^c be independent. Prove that A and B are independent.

   (a) In symbols, what are you trying to show? It is hard to imagine getting any marks without this part.

   (b) Now do the proof, using the formula sheet and the tabular format illustrated in lecture.

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3. (5 points) If you roll two fair dice, what is the probability that the sum is greater than 4? Circle the letter.

   A. 1/36
   B. 5/6
   C. 35/36
   D. 1/6

4. (5 points) A shipment of 150 electronic components has 3 defectives. If you randomly sample 10 components for testing, what is the probability of getting at least one defective? Circle the letter.

   A. $1 - \left(\frac{147}{150}\right)^3 \binom{10}{3}$
   B. $1 - \frac{\binom{147}{10}}{\binom{150}{10}}$
   C. $1 - \frac{\binom{147}{10}\binom{10}{3}}{\binom{150}{10}}$
   D. $1 - \frac{147}{150} \cdot \frac{146}{149} \cdot \frac{145}{148}$

5. (5 points) Repeatedly roll a fair die. What is the probability that the first 5 comes on the third roll? Circle the letter.

   A. $\left(\frac{1}{6}\right)^3$
   B. $25/6^3$
   C. $\left(\frac{5}{6}\right)^3$
   D. $1 - \left(\frac{3}{5}\right)^6$

6. (5 points) A jar contains 25 red marbles and 15 blue marbles. If you randomly select 10 balls without replacement, what is the probability of obtaining 7 red marbles and 3 blue marbles? Circle the letter.

   A. $\frac{\binom{7}{3}\binom{25}{15}}{\binom{40}{10}}$
   B. $\frac{\binom{25}{7}\binom{15}{3}}{\binom{40}{10}}$
   C. $\frac{\binom{10}{7}\binom{10}{3}}{\binom{40}{10}}$
   D. $\frac{\binom{7}{3}}{\binom{25}{15}}$

7. (5 points) If you toss a fair coin 6 times, what is the probability of observing exactly 3 heads? Circle the letter.

   A. 3/6
   B. $\binom{6}{3}/\binom{18}{6}$
   C. $1/2^6$
   D. $\binom{6}{3}/2^6$

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8. (5 points) Of the prisoners in a jail, 75% are convicted murderers and 50% have been convicted of both murder and armed robbery. Twenty percent are in jail for offences other than murder or armed robbery. If you pick a prisoner at random, what is the probability that she is an armed robber? Circle the letter.

   A. 0.25
   B. 0.35
   C. 0.27
   D. 0.05

9. (5 points) A jar contains 5 red marbles and 3 blue marbles. If you randomly select 5 balls *with* replacement, what is the probability of getting all blue balls? Circle the letter.

   A. 0
   B. $\frac{3}{8}$
   C. $\left(\frac{3}{8}\right)^5$
   D. $1 - \frac{\binom{3}{5}}{\binom{8}{5}}$

10. (5 points) In a club with 24 members, how many ways are there to choose a president and a vice president? Circle the letter.

    A. 276
    B. 24!
    C. 1/12
    D. 552

11. (5 points) A jar contains 5 red marbles and 3 blue marbles. If you randomly select 2 balls without replacement, what is the probability of obtaining a Red and then a Blue? Circle the letter.

    A. 75/83
    B. $\frac{\binom{5}{1}\binom{3}{1}}{\binom{8}{2}}$
    C. 15/56
    D. 15/64

12. (5 points) To pick a real number randomly from the interval [0,1], make the probability of any event equal to the length of that event. Let the event $A = \{1, \frac{1}{10}, \frac{1}{100}, \frac{1}{1000}, \ldots\}$. What is $P(A)$? Circle the letter.

    A. 0
    B. ∞
    C. 1
    D. $\frac{\pi}{256}$