

**Show all your work.** The work is more important than the answer. No work = no grade.

Attach this cover sheet to your work.

1. Are these variables discrete or continuous?
  - a) The speed of a swallow (African).
  - b) The number of coffees sold by the student cart.
  - c) The number of students attending the prom.
  - d) The weight of a duck.
  - e) The blood pressure of teachers at the end of the senior year.
  
2. Three out of four American university students under age 25 have eaten pizza for breakfast. If a random sample of 20 such students are selected, find the probability that:
  - a) exactly 16 have eaten pizza for breakfast.
  - b) at most 2 have not eaten pizza for breakfast.
  
3. Before a cell-phone leaves the factory, it is given a quality control check. The probabilities that the phone contains 0, 1, or 2 defects are 0.90, 0.06 and 0.04 respectively. In a sample of 12 phones, find the probability that 7 have no defects, 3 have 1 defect and 2 have 2 defects.
  
4. Approximately six in a thousand people have familial heterochromia. In a school population of 1942 students:
  - a) Find the expected number of students that carry this trait.
  - b) Find the probability that exactly 10 carry the trait.
  - c) Find the probability that at least one student carries this trait.
  
5. Suppose, we have an unfair coin for which the probability of getting a head is  $\frac{2}{3}$  and the probability of a tail is  $\frac{1}{3}$ . Consider tossing the coin five times in a row.
  - a) Find the probability of getting this sequence {HTTTT}.
  - b) Show which is more likely {HHTHH} or {HHHHT} or {TTTTH}?
  - c) Show which is more likely {4 heads and 1 tails} or {3 heads and 2 tails} or {2 heads and 3 tails}?
  
6. A gambling game involves a player drawing a card from a standard deck of 52. If they draw an ace they win twice their wager, if they draw a face card they will get their wager amount. If they draw any other card (two thru ten) they lose their wager. What should the wager be to ensure the house wins, on average, \$1 per game played?
  
7. Approximately 9% of the people in the world are left-handed. In a room of 200 find the probability that exactly 20 in the room are left handed.
  
8. A board of directors consist of seven men and five women. If a sub-committee of three is selected from the board members, find the probability that exactly two are women.
  
9. The probability that a Hydroflask water bottle will have 0, 1, 2, 3, or 4 defects are 0.9810, 0.0105, 0.0060, 0.0010, and 0.0005 respectively. If 12 bottles are inspected at random what is the probability that at least 10 will have no defects?
  
10. In April of 2018 1264 fish were counted heading up the Willamette Falls fish ladder and 2 of them were Spring Chinook. If fish runs remain constant what is the probability that at least 1 Spring Chinook will be counted at the Willamette Falls fish ladder in April 2019?

11. An ancient camel bone die was unearthed at an archaeological site. It was analyzed and found to have these probabilities:

Face, x	1	2	3	4	5	6
P(x)	0.1	0.1	0.18	0.18	0.22	0.22

Find the mean and standard deviation of this probability distribution.