

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

1. 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.
  
2. 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.
  
3. Approximately six in a thousand people have familial heterochromia. In a school population of 1540 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.
  
4. 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.
  
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 person shuffles a standard deck of playing cards, then deals three cards. What's the probability that all three cards are red?
  
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. The probability that a Hydroflask water bottle will have 0, 1, 2, or 3 defects are 0.98, 0.012, 0.008, and 0.002 respectively. If 6 bottles are inspected at random what is the probability that at least 3 will have no defects?
  
9. Write a probability distribution review question with fully worked answer. State the distribution you have used. Write it in the style of the questions you have been doing. It will be evaluated on how it well it demonstrates your understanding of the properties of the distribution chosen.