1. Consider the sample space $\Omega = \{a, b, c, d, e\}$. Given that $\{a, b, e\}$, and $\{b, c\}$ are both **events**, what other events are implied by taking unions, intersections, and compliments?

2. There are two positions - Cashier and Waiter - open at the local restaurant. There are two male applicants (David and Rajesh) two female applicants (Veronica and Megha). The Cashier position is chosen by selecting one of the four applicants at random. The Waiter position is then chosen by selecting at random one of the three remaining applicants.
   (a) List the elements of the sample space S.
   (b) List the elements of the event A that the position of Cashier is filled by a female applicant.
   (c) List the elements of the event B that exactly one of the two positions is filled by a female applicant.
   (d) List the elements of the event C that neither position was filled by a female applicant.
   (e) Sketch a Venn diagram to show the relationship among the events A, B, C and S.

3. Suppose there are only thirteen teams with a non-zero chance of winning the next World Cup. Suppose those teams are Spain (with a 14% chance), the Netherlands (with a 11% chance), Germany (with a 11% chance), Italy (with a 10% chance), Brazil (with a 10% chance), England (with a 9% chance), Argentina (with a 9% chance), Russia (with a 7% chance), France (with an 6% chance), Turkey (with a 4% chance), Paraguay (with a 4% chance), Croatia (with a 4% chance) and Portugal (with a 1% chance).
   (a) What is the probability that the next World Cup will be won by a South American country?
   (b) What is the probability that the next World Cup will be won by a country that is not from South America?

4. A biologist is modeling the size of a frog population in a series of ponds. She is concerned with both the number of egg masses laid by the frogs during breeding season and the annual precipitation into the ponds. She knows that in a given year there is an 86% chance that there will be over 150 egg masses deposited by the frogs (event E) and that there is a 64% chance that the annual precipitation will be over 17 inches (event F).
   (a) In terms of E and F, what is the event "there will be over 150 egg masses and an annual precipitation of over 17 inches"?
   (b) In terms of E and F, what is the event "there will be 150 or fewer egg masses and the annual precipitation will be over 17 inches"?
   (c) Suppose the probability of the event from (a) is 59%. What is the probability of the event from (b)?

5.

(a) Suppose we roll a die and so $S = \{1, 2, 3, 4, 5, 6\}$. Each outcome separately $\{1\}, \{2\}, \{3\}, \{4\}, \{5\}, \{6\}$ is an event. Suppose each of these events is equally likely. What must the probability of each event be? What axioms or properties are you using to come to your conclusion?

(b) With the same assumptions as in part (a), how would you determine the probability of an event like $E = \{1, 3, 4, 6\}$? What axioms or properties are you using to come to your conclusion?

(c) If $S = \{1, 2, 3, ..., n\}$ and each single-outcome event is equally likely, what would be the probability of each of these events?

(d) Suppose $E \subset S$ is an event in the sample space from part (c). Explain how you could determine $P(E)$.