Probability Questions From Past IB Exams

1. A bag contains 2 red balls, 3 blue balls and 4 green balls. A ball is chosen at random from the bag and is not replaced. A second ball is chosen. Find the probability of choosing one green ball and one blue ball in any order.

2. In a bilingual school there is a class of 21 pupils. In this class, 15 of the pupils speak Spanish as their first language and 12 of these 15 pupils are Argentine. The other 6 pupils in the class speak English as their first language and 3 of these 6 pupils are Argentine.

A pupil is selected at random from the class and is found to be Argentine. Find the probability that the pupil speaks Spanish as his/her first language.

3. For the events A and B, $p(A) = 0.6$, $p(B) = 0.8$ and $p(A \cup B) = 1$.

Find

(a) $p(A \cap B)$

(b) $p(\complement \mathrm{A} \cup \complement B)$

4. A fair coin is tossed eight times. Calculate

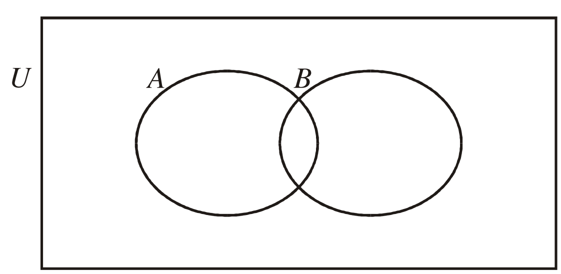
(a) the probability of obtaining exactly 4 heads;

(b) the probability of obtaining exactly 3 heads;

(c) the probability of obtaining 3, 4 or 5 heads.

5. The local Football Association consists of ten teams. Team A has a 40 % chance of winning any game against a higher-ranked team, and a 75 % chance of winning any game against a lower-ranked team. If A is currently in fourth position, find the probability that A wins its next game.

6. The following Venn diagram shows a sample space U and events A and B.



$n(U) = 36$, $n(A) = 11$, $n(B) = 6$ and $n(A \cup B)' = 21$.

(a) On the diagram, shade the region $(A \cup B)'$.

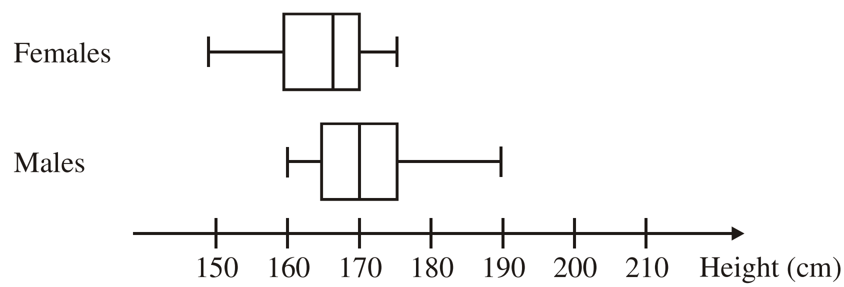
(b) Find

(i) $n(A \cap B)$;

(ii) $P(A \cap B)$.

(c) Explain why events A and B are not mutually exclusive.

7. The box-and-whisker plots shown represent the heights of female students and the heights of male students at a certain school.



(a) What percentage of female students are shorter than any male students?

(b) What percentage of male students are shorter than some female students?

(c) From the diagram, **estimate** the mean height of the male students.

8. Given that events A and B are independent with $P(A \cap B) = 0.3$ and $P(A \cap B') = 0.3$, find $P(A \cup B)$.

9. A girl walks to school every day. If it is not raining, the probability that she is late is $\frac{1}{5}$. If it is raining, the probability that she is late is $\frac{2}{3}$. The probability that it rains on a particular day is $\frac{1}{4}$.

On one particular day the girl is late. Find the probability that it was raining on that day.

10. Given that $P(X) = \frac{2}{3}$, $P(Y|X) = P(Y|X') = \frac{1}{4}$, , find

(a) $P(Y')$;

(b) $P(X' \cup Y')$.

11. The probability that a man leaves his umbrella in any shop he visits is $\frac{1}{3}$. After visiting two shops in succession, he finds he has left his umbrella in one of them. What is the probability that he left his umbrella in the second shop?

12. Two fair dice are thrown and the number showing on each is noted. The sum of these two numbers is S. Find the probability that

(a) S is less than 8;

(b) at least one die shows a 3;

(c) at least one die shows a 3, given that S is less than 8.

13. Two children, Alan and Belle, each throw two fair cubical dice simultaneously. The score for each child is the sum of the two numbers shown on their respective dice.

(a) (i) Calculate the probability that Alan obtains a score of 9.

(ii) Calculate the probability that Alan and Belle both obtain a score of 9.

(b) (i) Calculate the probability that Alan and Belle obtain the same score,

(ii) Deduce the probability that Alan's score exceeds Belle's score.

(c) Let X denote the largest number shown on the four dice.

(i) Show that for $\mathrm{P}(X \leq x) = \left(\frac{x}{6}\right)^4$, for $x = 1, 2, \ldots 6$

(ii) Copy and complete the following probability distribution table.

x	1	2	3	4	5	6
$\mathrm{P}(X = x)$	$\frac{1}{1296}$	$\frac{15}{1296}$				$\frac{671}{1296}$

(iii) Calculate $\mathrm{E}(X)$.

14. Jack and Jill play a game, by throwing a die in turn. If the die shows a 1, 2, 3 or 4, the player who threw the die wins the game. If the die shows a 5 or 6, the other player has the next throw. Jack plays first and the game continues until there is a winner.

(a) Write down the probability that Jack wins on his first throw.

(b) Calculate the probability that Jill wins on her first throw.

(c) Calculate the probability that Jack wins the game.

15. Given that $(A \cup B)' = \varnothing$, $\mathrm{P}(A'|B) = \frac{1}{3}$ and $\mathrm{P}(A) = \frac{6}{7}$, find $\mathrm{P}(B)$.