PROBABILITY - IB SAMPLE PROBLEMS

1. The following table shows the probability distribution of a discrete random variable X.

x	–1	0	2	3
P ($X = x$)	0.2	$10k^2$	0.4	$3k$

(a) Find the value of k.

(4)

(b) Find the expected value of X. **(3)**

(Total 7 marks)

2. A discrete random variable X has a probability distribution as shown in the table below.

x	0	1	2	3
P($X = x$)	0.1	a	0.3	b

(a) Find the value of $a + b$.

(2)

(b) Given that E(X) =1.5, find the value of a and of b. **(4)**

(Total 6 marks)

3. There are 20 students in a classroom. Each student plays only one sport. The table below gives their sport and gender.

	Football	**Tennis**	**Hockey**
Female	5	3	3
Male	4	2	3

(a) One student is selected at random.

(i) Calculate the probability that the student is a male or is a tennis player.

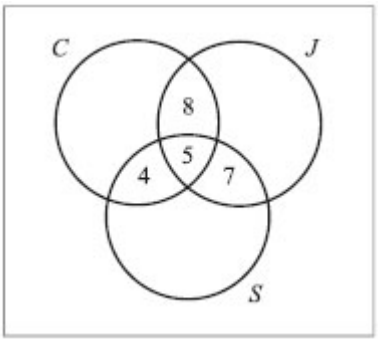
(ii) Given that the student selected is female, calculate the probability that the student does not play football.

(4)

(b) Two students are selected at random. Calculate the probability that neither student plays football. **(3)**

(Total 7 marks)

4. The Venn diagram below shows information about 120 students in a school. Of these, 40 study Chinese (C), 35 study Japanese (J), and 30 study Spanish (S).



A student is chosen at random from the group. Find the probability that the student

(a) studies exactly two of these languages;

(1)

(b) studies only Japanese;

(2)

(c) does not study any of these languages. **(3)**

(Total 6 marks)

5. In a class, 40 students take chemistry only, 30 take physics only, 20 take both chemistry and physics, and 60 take neither.

(a) Find the probability that a student takes physics given that the student takes chemistry.

(b) Find the probability that a student takes physics given that the student does **not** take chemistry.

(c) State whether the events "taking chemistry" and "taking physics" are mutually exclusive, independent, or neither. Justify your answer.

(Total 6 marks)

6. Consider the events A and B, where $P(A) = \frac{2}{5}$, $P(B') = \frac{1}{4}$ and $P(A \cup B) = \frac{7}{8}$.

(a) Write down $P(B)$.

(b) Find $P(A \cap B)$.

(c) Find $P(A \mid B)$.

(Total 6 marks)

7. Events E and F are independent, with $P(E) = \frac{2}{3}$ and $P(E \cap F) = \frac{1}{3}$. Calculate

(a) $P(F)$;

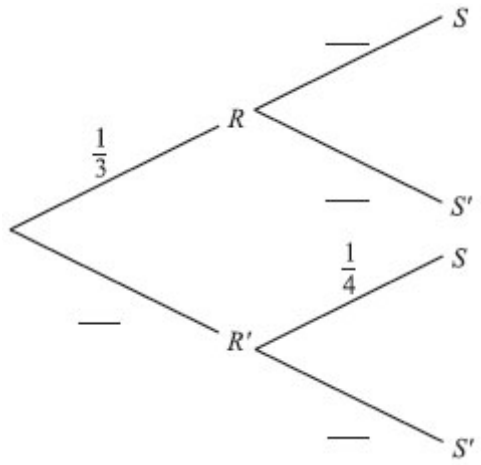
(b) $P(E \cup F)$.

(Total 6 marks)

8. The following probabilities were found for two events R and S.

$$P(R) = \frac{1}{3},\ P(S \mid R) = \frac{4}{5},\ P(S \mid R') = \frac{1}{4}.$$

(a) **Copy** and **complete** the tree diagram.



(3)

(b) Find the following probabilities.

(i) $P(R \cap S)$.

(ii) $P(S)$.

(iii) $P(R \mid S)$.

(7)
(Total 10 marks)

9. Two restaurants, *Center* and *New*, sell fish rolls and salads.

Let F be the event a customer chooses a fish roll.
Let S be the event a customer chooses a salad.
Let N be the event a customer chooses neither a fish roll nor a salad.

In the *Center* restaurant $P(F) = 0.31$, $P(S) = 0.62$, $P(N) = 0.14$.

(a) Show that $P(F \cap S) = 0.07$.

(3)

(b) Given that a customer chooses a salad, find the probability the customer also chooses a fish roll.

(3)

(c) Are F and S independent events? Justify your answer.

(3)

At *New* restaurant, $P(N) = 0.14$. Twice as many customers choose a salad as choose a fish roll. Choosing a fish roll is **independent** of choosing a salad.

(d) Find the probability that a fish roll is chosen.

(7)
(Total 16 marks)