IB Math SL Review
Probability

This worksheet is *not* required, and it will not be graded. A question from this topic will appear on the quiz on §3.5-3.8. Answers, but not worked out solutions, will appear on Edmodo. You may discuss how to do the problems in the thread on Edmodo and help each other with them. However, we will not be working on them in class. You might only be allowed a calculator on problems 6, 7, and 9.

5.5	Concepts of trial, outcome, equally likely outcomes, sample space (U) and event. The probability of an event A is $P(A)=\frac{n(A)}{n(U)}$. The complementary events A and A' (not A). Use of Venn diagrams, tree diagrams and tables of outcomes.
5.6	Combined events, P($A \cup B$). The non-exclusivity of "or." Mutually exclusive events: P($A \cap B$) = 0. Conditional probability; the definition $P(A \mid B)=\frac{P(A\cap B)}{P(B)}$. Independent events; the definition P(A|B) = P(A) = P(A|B'). Probabilities with and without replacement.
5.7	Concept of discrete random variables and their probability distributions. Expected values (mean), E(X) for discrete data. Applications, including games of chance.
5.8	Binomial distribution. Mean and variance of the binomial distribution. Conditions under which random variables have this distribution.

1. 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($A \mid B$).

2. 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($E \cup F$).

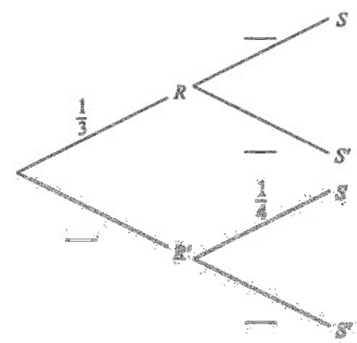
3. Paula goes to work three days a week. On any day, the probability that she goes on a red bus is $\frac{1}{4}$.

(a) Write down the expected number of times that Paula goes to work on a red bus in one week.
In one week, find the probability that she goes to work on a red bus
(b) on exactly two days; (c) on at least one day.

4. 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 at right.
(b) Find the following probabilities.
(i) P($R \cap S$). (ii) P(S). (iii) P($R \mid S$).

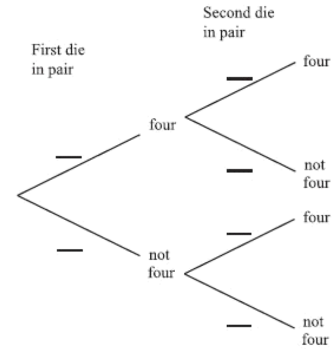


5. In a class, 40 students take chemistry only, 30 take physics only, 20 take both chemistry and physics, and 60 take neither.
(a) Find the probability that a student takes physics given that the student takes chemistry.
(b) Find the probability that a student takes physics given that the student does **not** take chemistry.
(c) State whether the events "taking chemistry" and "taking physics" are mutually exclusive, independent, or neither. Justify your answer.

6. A factory makes switches. The probability that a switch is defective is 0.04.
The factory tests a random sample of 100 switches.
(a) Find the mean number of defective switches in the sample.
(b) Find the probability that there are exactly six defective switches in the sample.
(c) Find the probability that there is at least one defective switch in the sample.

7. A pair of fair dice is thrown.

(a) Copy and complete the tree diagram here, which shows the possible outcomes.



Let E be the event that **exactly** one four occurs when the pair of dice is thrown.

(b) Calculate $P(E)$.

The pair of dice is now thrown five times.

(c) Calculate the probability that event E occurs **exactly** three times in the five throws.

(d) Calculate the probability that event E occurs **at least** three times in the five throws.

8. 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.

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

9. 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.

(b) Find the expected value of X.

10. Three students, Kim, Ching Li and Jonathan each have a pack of cards, from which they select a card at random. Each card has a 0, 3, 4, or 9 printed on it.

(a) Kim states that the probability distribution for her pack of cards is as follows.

x	0	3	4	9
$P(X = x)$	0.3	0.45	0.2	0.35

Explain why Kim is incorrect.

(b) Ching Li correctly states that the probability distribution for her pack of cards is as follows.

x	0	3	4	9
$P(X = x)$	0.4	k	$2k$	0.3

Find the value of k.

(c) Jonathan correctly states that the probability distribution for his pack of cards is given by $P(X = x) = \dfrac{x+1}{20}$. One card is drawn at random from his pack.

(i) Calculate the probability that the number on the card drawn is 0.

(ii) Calculate the probability that the number on the card drawn is greater than 0.