Question 1

Assume that there are three different routes to get to a particular location: R_1, R_2 and R_3. You take R_1 75% of the time, R_2 20% of the time and R_3 the rest of the time. If you take R_1, there is a 90% chance that you will be on time; if you take R_2, there is a 50% chance that you will be on time and, if you take R_3, there is a 70% chance that you will be on time.

Let T represent on time.

(a) If T represents "on time", what notation would we use for "late"? **(b)** What is the value of $\Pr(R_1 \cap R_2)$? **(c)** Calculate the probability of being on time. **(d)** *Given that* you *are* on time, calculate the probabilities of having used each of the routes. **(e)** Given that you are late, what is the probability that you used R_1?

Question 2

Assume that 40% of emails you receive can be classed as "spam". Your spam filter places 90% of spam emails in the spam folder and 1% of non-spam emails in the spam folder.

(a) Using appropriate notation, convert the above into mathematical statements. **(b)** What proportion of your emails go to the spam folder? **(c)** Given that an email is in the spam folder, what is the probability that it is in fact spam? **(d)** Given that the email is *not* in the spam folder, what is the probability that it is spam?

Question 3

Let's assume you have four shirts (green, red, brown, black), two jackets (blue, black) and two pairs of trousers (brown, black).

(a) How many outfits have you got altogether? **(b)** What if the shirt must be red? **(c)** What if the shirt must be green or black? **(d)** What if the shirt must be green and the jacket must be blue? **(e)** What if no item is to be black? **(f)** What if at least one item must be black? **(g)** What if the shirt and jacket can be the same colour but the trousers must be a different colour?

Question 4

You must create a password of length 5 using the following characters: $\{a, b, c, d, 1, 2, 3, 4\}$.

(a) How many possible passwords are there? **(b)** What if you only use letters? **(c)** What if first character cannot be a number? **(d)** How many passwords contain *at least one* number? **(e)** What if each character must be different?

Question 5

In your favourite RPG game, let's assume that in selecting your character there are 5 character classes and 2 genders. Let's also assume there are 3 levels of difficulty for this game.

(a) How many possible ways can you play this game? **(b)** What if you always choose the "warrior" class? **(c)** What if you always choose a female character? **(d)** What if you always play on the highest difficulty setting? **(e)** Let's assume the game has a two-player mode. How many possible ways can you play this game? (hint: you cannot play the game on different difficulty levels). **(f)** What if your friend chooses a different character class to you?

Question 6

Assume that you are going to an exam and you can only bring 3 items. You have the following items: {mobile phone, pen, ruler, calculator, laptop, apple}.

(a) In order to make your decision, you first *arrange* these 6 items on your desk. How many possible arrangements are there?   **(b)** How many possible groups of three items can you bring with you?   **(c)** What if you decide that the pen is essential?   **(d)** What if the pen is essential and you also decide that you won't bring an apple or a laptop?

Question 7

A team of 5 people is required to perform a particular task. We are selecting from a group of 7 women and 3 men.

How many selections are there:

(a) Altogether?   **(b)** If one of the men is an expert and must be on the team?   **(c)** If two of the individuals do not get along and cannot be on the team together?   **(d)** If the group must contain 3 women and 2 men? **(e)** If the group must contain more women than men?   **(f)** If the group must contain more men than women?