Question 1

Consider the experiment where three coins are flipped.

(a) List all possible outcomes. **(b)** Calculate Pr(more heads than tails)?
(c) Calculate Pr(two tails)?

Question 2

Let W = "the individual uses Windows" and M = "the individual uses Mac".
Furthermore $\Pr(W) = 0.7$, $\Pr(M) = 0.2$ and $\Pr(W \cap M) = 0.1$.

(a) Calculate the probability that an individual uses at least one of the two operating systems? **(b)** Calculate the probability that an individual uses neither? **(c)** Are W and M mutually exclusive? **(d)** Are W and M independent?

Question 3

Let $\Pr(A) = 0.45$, $\Pr(B) = 0.6$ and $\Pr(A \cup B) = 0.75$.

(a) Calculate $\Pr(A \cap B)$? **(b)** Are A and B independent? **(c)** Calculate $\Pr(A^c)$ and $\Pr(B^c)$. **(d)** Calculate $\Pr(A^c \cup B^c)$.

Question 4

Consider a RAID (redundant array of inexpensive disks) system where multiple hard disks are used simultaneously.

Let's assume that we have two hard disks that work *independently* of each other. Define the events H_1 = "hard disk one works" and H_2 = "hard disk two works" and also assume that $\Pr(H_1) = \Pr(H_2) = 0.9$.

- RAID-0 is a system which increases performance but only works if *both* hard disks work.
- RAID-1 is a system which does not increase performance but still works with only one working hard disk.

(a) Calculate Pr(RAID-0 works) and Pr(RAID-0 fails). **(b)** Calculate Pr(RAID-1 works) and Pr(RAID-1 fails). **(c)** Calculate $\Pr(H_1^c)$ and $\Pr(H_2^c)$.

(d) Cheap hard disks exist with $\Pr(H) = 0.6$. Consider a RAID-1 system with 3 of these hard disks - calculate Pr(RAID-1 fails) in this case. **(e)** In part (a) we found that Pr(RAID-1 fails) = 0.01. How many cheap disks would be required to match this level of reliability?

Question 5

A software company examined blocks of code written by its employees. Each block of code was tested for bugs and, in addition, the skill level of the employee was also recorded. See table:

		Skill Level			
		High	Average	Low	Total
Bug in Code	No	140	600	100	840
	Yes	5	70	40	115
	Total	145	670	140	955

In answering the following questions use appropriate probability notation.

Let B = "bug" and, hence, B^c = "no bug".
Also let S_H = "skill: high", S_A = "skill: average" and S_L = "skill: low".

(a) Calculate the probability that the programmer has: (i) high skill, (ii) average skill and (iii) low skill. **(b)** Calculate the probability of a bug. **(c)** Calculate the probability of a bug *given that* the code was written by a programmer with: (i) high skill, (ii) average skill and (iii) low skill. **(d)** Comment on the above conditional (i.e., updated) probabilities compared with $\Pr(B)$ calculated in part (b). Is the presence of bugs independent of the skill level? **(e)** Show that $\Pr(S_A \mid B) > \Pr(S_L \mid B)$. Explain the reason for this.