Problem H-301. On Mars there are 669 Martian solar days per year (ignoring leap years).

(a) In a group of 7 Martians, chosen at random, what is the probability that at least two share a birthday? Give your answer to 4 decimals.

(b) At what number of Martians is there approximately a 20% chance that at least two of them share a birthday? Use the formula for estimating this on the “birthday problem” slides.

Problem H-302.

(a) If $w$ is a string of English letters A–Z (all uppercase for the purposes of this problem), let $w^r$ denote the reverse of $w$; (TRAIN)$^r$=NIART. A palindrome is a string that is its own reversal: $w = w^r$. For example, BZRZB is a palindrome of length 5. We are not concerned with whether it is an actual English word. Find a formula for the number of palindromes of length $k$. You will need to treat odd ($k = 2m + 1$) and even ($k = 2m$) lengths differently.

(b) If $w$ is a DNA sequence (in the letters A, C, G, T), let $w^\#$ denote the reverse complement (change $A \leftrightarrow T$ and $C \leftrightarrow G$ and reverse the order of the letters); for example, (ATAGC)$^\#$=GCTAT. A DNA palindrome is a DNA sequence that is its own reverse complement: $w^\# = w$. For example, ACTAGT is a DNA palindrome of length 6. Find a formula for the number of DNA palindromes of length $k$. Again, you will need to treat odd and even lengths differently.