Q1.1

This problem can be solved using binomial distribution. Probability of winning a match is 0.6. Matches left.

P= P(win) + P(lose)

Formula = $p^k(1-p)^{(n-k)}$

$$P = \binom{8}{1}(.6)^1(.4)^7 + \binom{8}{1}(.6)^7(.4)^1 = 0.097$$

Q1.2

In this question we were required to find the winning probability of a player in a game of tennis. It was given that the game is tied at 40:40. This problem can also be solved using binomial distribution. We have two scenarios:

p =p(w), 1-p = p(l)

1)WLWLWWLWL….

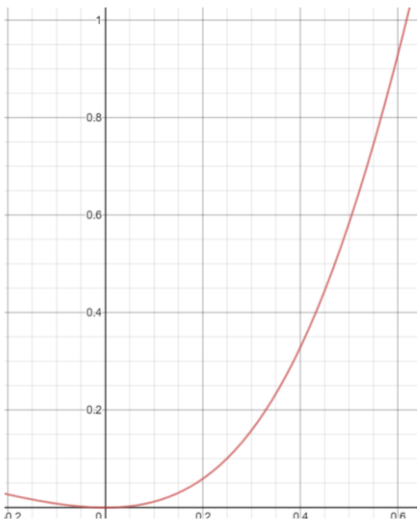
2)WW,WlWWW…..

So adding both probabilities:

$P(W) = p^2 * (1 + (1-p)p + (1-p)^2 * p^2 + ...) + ((1-p)*p^3)*(1 + (1-p)p + (1-p)^2 * p^2 + ...)$

Using the summation formula of the infinite series: $P(W) = (p^2 + p^3 + p^4) / (1 – p + p^2)$

Graph:



Q4.1

For the uniqueness of the solution we are given $||w_1|| = 1$, and also $\sum = COV(x)$.

So considering this and that $w^T{}_1\, x = z_1$

$w^T{}_1\, E[(x - \mu)(x - \mu)^T]w_1 = w^T{}_1\Sigma w_1 = Var(z_1)$.

IF we take derivative with respect to $\sum w_1$ and equating it to zero, we have $\Sigma w_1 = a\, w_1$

Hence w_1 can be considered as eigen vector of $\sum$ and Λ is the corresponding Eigen value.

Hence the largest $\Lambda = a_1$

While maximizing the w, it is necessary to use Lagrange method.

Q4.2

In this part we are to show, that the second component is the eigenvector of the covariance matrix with the second largest eigenvalue. So to prove this the second principal component W_2 should also maximize variance, be unit length, and orthogonal to w_1.

So in this part we also maximize $w^T \sum w$ called as w_2. Takig the derivative and equating it to zero, and then multiply with the transpose, we get $\Sigma w_2 = a_2\, w_2$

Hence a_2 is the second largest eigen value.