1. The one step transition probabilities of a Markov chain with three states (0, 1, 2) are given below:

$P_{00} = 0.2$, $P_{02} = 0.5$, $P_{10} = 0.1$, $P_{11} = 0.3$, $P_{21} = 0.4$, $P_{20} = 0.4$

(a) Construct the One step TPM based on the above given information. **[3]**

(b) Calculate the steady state probabilities. **[5]**

2. The time to failure of a television tube is estimated to be exponentially distributed with mean of 3 years. A company offers insurance on these tubes for the first 2 year of usage.

(a) On what percentage of policies will they have to pay a claim? **[3]**

(b) If they are ready to pay claim to 25% customers, what will be their warranty period? **[3]**

3. On each of 18 days, samples of 90 printed circuit boards are subjected to thermal cycling; that is, they are subjected to large changes in temperature, a procedure known to cause failures in boards with weak circuit connections. Of the boards tested, a total of 478 fail to work properly after the thermal cycling test.

(a) From this information, calculate the center line and control limits for a p chart. **[3]**

(b) The highest number of failures on a given day was 39 and the lowest number was 13. Would either of these points indicate an out-of-control condition? **[3]**

4. Some uniform random numbers are given below:

0.17 0.29 0.42 0.68 0.82

(a) Using the above uniform random numbers, generate random numbers that follow Normal distribution with mean 25 and standard deviation 5. **[5]**

(b) Using the above uniform random numbers, find the value of the following Monte Carlo Integration: $\int_1^8 (x^2 - 2x)\, dx$ **[5]**