1. Let population growth model is represented by $\frac{dN}{dt} = rN(1 - \frac{N}{K})$, where N represents the population size, $r(> 0)$ is the growth rate and $K(> 0)$ is the carrying capacity.

a. Find all the fixed points of this model.

b. Which of these fixed points are stable? Why? (Explain it from the perturbation technique. Consider $\dot{x} = f(x)$, a fixed point as $x*$. Calculate the general condition of stability.)

c. Analytically solve the differential equation and check whether long term evolution of the solution converges to the stable fixed point(s).

d. The population will remain unchanged irrespective of r and K if it starts form a non-zero population (away from K). Is it correct? Explain.

$[2 + 3 + 4 + 1 = 10]$

2a. Develop the pseudo code that uses the iterative QR method to determine a matrix's eigenvalues. Describe the mechanism. What causes the eigenvalues to stay constant throughout this iterative process?

2b. Explain the process (using pseudo code) to determine a connected undirected graph's leading eigenvector. When does this process become slower? Why?