1. (a) Suppose data are available on two variables X and Y. Draw rough sketches of the plots of Y versus X for the following values of the correlation coefficient (r_{xy}) between X and Y:

    i. $r_{xy} = 0$

    ii. $r_{xy} = -1$

    iii. $r_{xy} = 0.8$

(b) Suppose data are available on a variable X. The variance of X is 4. If Y is defined as *(16 - 3X)/5*, find the standard deviation of Y.

2. Consider a recessive disorder controlled by the minor allele of an autosomal biallelic locus that conforms to Hardy-Weinberg Equilibrium. If 42% of the population are carriers, what is the percentage of unaffected individuals in the population? What is the chance that the offspring of a pair of carriers is unaffected?

3. Explain the following differences between prokaryotes and eukaryotes:

    (a) Poly-cistronic mRNAs are observed in prokaryotes but not in eukaryotes.

    (b) Transcription and translation is a simultaneous process in prokaryotes, but not in eukaryotes.

4. (a) During each cell division, telomere is shortened. Suppose this process limits cell division by 50 generations. Explain how can tumor be formed in human in spite of the above phenomenon?

(b) Some miRNAs function as oncomir in one type of cancer, while the same miRNA can act as a tumor suppressor miRNA in another type of cancer. Explain how is this possible?

5. (a) Describe briefly three distinct mechanisms of immune surveillance evasion by tumor cells.

(b) Distinguish between the immunity and adaptive immunity.