Student Name:

Homework # 6

Instructions: Prepare your deliverables in clean letter size printer-quality papers with a high-contrast pencil (engineering pads are also accepted). Attach this assignment sheet as cover page, show all your work, and box all your solutions. All Matlab code needs to be published, and all figures needs to have proper axis labeling and legends. Homework assignments will be collected during class time on the due date. *No late homework or submission that do not strictly follow the provided instructions will not be accepted.*

- **Homework problems not to be graded**
  - From textbook:
    - Ch 4: 2.2, 3.1, 4.6, 5.10, 6.4, 7.2, 7.3

- **Homework problems to be graded**

In a country with a population of 100 million, the heights of its people are independent Gaussian random variables with expected value of 5'10" (70 inches). It is also known that 500,000 people in the country are at least 7' tall (84 inches). Show all your work in calculating the following.

a) Calculate the standard deviation of the height of the people in the country.
b) Calculate the probability that a person in the country is at least 6' tall.
c) The N be the number of people in the country that are at least 6' tall. What is the probability that 50% of the population is over 6' tall? (Hint: determine which family the discrete random variable N belongs to)
d) Determine the expected value of N?

a) $x = 84 \quad \mu = 70 \quad z = \Phi\left(\frac{50{,}000}{100{,}000{,}000}\right) = \Phi(0.005) = -3.3$

$$\sigma = \frac{x - \mu}{z} = \frac{84 - 70}{3.3} = \boxed{4.24}$$

b) $x = 72 \quad \mu = 70 \quad \sigma = 4.24$

$$z = \frac{x - \mu}{\sigma} = \frac{72 - 70}{4.24} = 0.47 = \Phi(0.3192)$$

c) Binomial RV

$$P_X(50{,}000{,}000) = \binom{100{,}000{,}000}{50{,}000{,}000} \cdot 0.3192^{50{,}000{,}000} \cdot 0.6808^{50{,}000{,}000}$$

d) Binomial (n, p): $E[X] = np$

$$E[N] = 100{,}000{,}000 \cdot 0.3192 = \boxed{31{,}920{,}000}$$