7: (7 pts.) Suppose X is binomial with $n = 100$ and $p = 0.5$. Approximate the probability $P(4 < X \leq 6)$ using EITHER the Poisson OR normal approximation. If you use the Poisson approximation, derive an expression for the approximate probability but do not evaluate/simplify it to a decimal fraction. If you use the normal approximation, derive an expression for the approximate probability in terms of the standard normal RV Z but do not evaluate/simplify it to a decimal fraction.

Poisson Approx.:

$$\lambda = np = 100(.5) = 50 \quad \} 2$$

$$P(4 < X \leq 6) \cong P(Y=5) + P(Y=6) \quad \} 2$$

$$= e^{-50}\frac{50^5}{5!} + e^{-50}\frac{50^6}{6!} \quad \} 3$$

Normal Approx.:

$$\mu = np = 100(.5) = 50$$
$$\sigma = \sqrt{np(1-p)} = \sqrt{100(.5)(.5)} = 5 \quad \} 4$$

$$P(4 < X \leq 6) \cong P(4.5 \leq W \leq 6.5) \quad \} 2$$

$$= P\left(\frac{4.5-50}{5} \leq Z \leq \frac{6.5-50}{5}\right) \quad \} 1$$

$$= P\left(\frac{-45.5}{5} \leq Z \leq \frac{-43.5}{5}\right)$$

$$= P(-9.1 \leq Z \leq -8.7)$$