

Math 373 Hw 9 Worked examples and comments.

225: 6.34abc, 6.40, 6.44. 240: 7.2, 7.4. Rec 225: 6.33, 6.35, 6.43. 240: 7.3, 7.5, 7.7.

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6.40 Data collected over a long period of time show that a particular genetic defect occurs in one out of every 1000 children. The records of a medial clinic show $x = 60$ children with the defect in a total of 50,000 examined. If the 50,000 children were a random sample from the population of children represented by past records, what is the probability of observing a value x equal to 60 or more?

Answer: This is a binomial distribution. But since the numbers are large, we will approximate the answer using the normal distribution.

x = the number of children with the defect, then
"success" = having the defect.

n = number in sample = 50,000.

p = probability of success = $1/1000 = .001$

$q = .999$

$\mu = np = 50000(.001) = 50.$

$\sigma = \sqrt{npq} = \sqrt{50000(.001)(.999)} = 7.07$

$P_B(x \geq 60) = P_N(x \geq 59.5) = P_N\left(\frac{x - \mu}{\sigma} \geq \frac{59.5 - 50}{7.0675}\right)$

$= P_N(z \geq 1.3442) = .5 - P_N(0 \leq z \leq 1.34)$

$= .5 - .4099 = .09$

The probability of observing a value x equal to 60 or more is 9%

From Lecture 9

- A potter must fill an order for 180 glazed pots. The glazing process cracks 20% of the pots. What is the probability that he can produce 180 crack-free items from 200 unglazed pots?

This is a binomial experiment.

Is n 180 or 200?

Is k 180 or 200? Hint: $k \leq n$.

n is the number of trials. Since he has 200 pots, he gets 200 trials.

We want the probability of getting 180 crack-free items.

Hence we are counting the number of crack-free items.

Thus "success" is getting a crack-free item and

x = the number of successes = the number of crack-free items.

p = probability of success = .80

$q = .20$

$\mu = np = 200(.80) = 160$

$\sigma = \sqrt{npq} = \sqrt{200(.2)(.8)} = 5.6569$

The probability of getting 180 crack-free items =

$P(x \geq 180) = P_B(x \geq 180) \approx P_N(x \geq 179.5) =$

$P_N\left(\frac{x - \mu}{\sigma} \geq \frac{179.5 - 160}{5.6569}\right) = P_N(z \geq 3.4471) \approx 100\%$