AP Statistics – Binomial Probability Models II

1. Suppose the Texas Red Cross anticipates the need for at least 1850 units of O-negative blood this year. It estimates that it will collect blood from 32,000 donors. If 6% of the adult population has type O-negative blood, how great is the risk that they will fall short of their need?

# of donors < 1850

X = # of O-negative donors

$n = 32000 \quad p = 0.06$

$$P(X < 1850) = \binom{32000}{0}(0.06)^0(0.94)^{32000} + \ldots + \binom{32000}{1849}(0.06)^{1849}(0.94)^{32000-1849}$$

[better use BinomCDF(32000, 0.06, 1849)!]

$$\underset{n}{32000}, \ \underset{p}{0.06}, \ \underset{x}{1849}$$

$$= \boxed{0.0479}$$

USING A NORMAL MODEL TO APPROXIMATE A BINOMIAL MODEL

A binomial model is **approximately normally distributed** if we expect at least 10 successes and 10 failures:

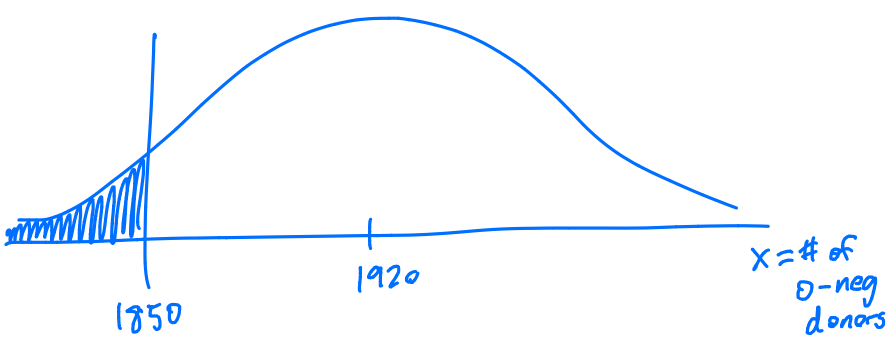
$np \geq 10$ and $nq \geq 10$

2. Calculate the same probability (that the Texas Red Cross will collect fewer than 1850 units of O-negative blood) by using a Normal Model approximation.

Find mean & st. dev: $\mu_x = np = 32000(0.06) = 1920$

$\sigma_x = \sqrt{np(1-p)} = \sqrt{32000(0.06)(0.94)} = 42.4829$

$N(1920, 42.4829)$



$$z = \frac{\text{obs} - \text{mean}}{SD} = \frac{1850 - 1920}{42.4829} = -1.6477$$

Check for Normality:

$np = 32000(0.06) = 1920 \geq 10$ ✓

$nq = 32000(0.94) = 30080 \geq 10$ ✓

(so a Normal model is good to go!)

$P(z < -1.6477)$

$= \boxed{0.0497}$

very close to answer to #1!