Solutions to Quiz 1 Binomial and Normal Distributions 3−22−17 version 100

1) P(x< 22) implies P(x≤21)

Note: this boundary adjustment is due to discrete nature of binomial

n = 100 (max) p =0.2

macro $\text{binomCdf}(100,0.2,0,21) \approx 0.654033$

2) P(x≥22)

Note: NO boundary adjustment is necessary

n = 200 (max) p =0.4

macro $\text{binomCdf}(200,0.4,22,200) \approx 1.$

This cannot be 1 because it is possible for this NOT to happen

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3) P(x>19) implies P(x≥20)

Note: this boundary adjustment is due to discrete nature of binomial

n = 50 (max) p =0.4

macro $\text{binomCdf}(50,0.4,20,50) \approx 0.553524$

This cannot be zero because it is possible for this to happen

Since we are approximating binomial IT determines the boundaries and what we need to make the continuity correction on

Note: these boundary adjustments are due to using continuous to approximate discrete

n = 50 (max) p =0.4 q = 1−0.4 = 0.6

np = mean $=50\cdot 0.4 \blacktriangleright 20.$ SD $= \sqrt{npq} = \sqrt{50\cdot 0.4\cdot 0.6} \blacktriangleright 3.4641$

macro $\text{normCdf}(19.5,50.5,20,3.464) \approx 0.557385$

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4) P(x= 5)

n = 30 (max) p =0.2

macro $\text{binomPdf}(30,0.2,5) \approx 0.172279$

Since we are approximating binomial IT determines the boundaries and what we need to make the continuity correction on

Note: these boundary adjustments are due to using continuous to approximate discrete

n = 30 (max) p =0.2 q = 1−0.2 = 0.8

np = mean $=30\cdot 0.2 \blacktriangleright 6.$ SD $= \sqrt{npq} = \sqrt{30\cdot 0.2\cdot 0.8} \blacktriangleright 2.19089$

macro $\text{normCdf}(4.5,5.5,6,2.191) \approx 0.162951$

This cannot be zero because it is possible for this to happen

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ALL these problems are normally distributed, no adjustment of boundaries is necessary

mean = 700 SD = 45

5) Usual range is within two standard deviations of the mean

Usual min $=700-2\cdot 45 = 610$ Usual max $= 700+2\cdot 45 = 790$

Usual Range 610 to 790

6) P(less than 720) = P(0<x<720) $=\text{normCdf}(0,720,700,45) = 0.671639$

7) P(more than 695) =

P(695<x<1000000000000) $=\text{normCdf}(695,1000000000000,700,45) = 0.544236$

8) P(between 650 and 775) = P(650<x<775) $=\text{normCdf}(650,775,700,45) = 0.818949$

9) P(x > VALUE 1) = 0.05 complement to VALUE 1 probability $1-0.05 = 0.95$

P(x < VALUE 1) =0.95 $\text{invNorm}(0.95,700,45) = 774.018$ =VALUE 1

10) P(x < VALUE 2) =0.23 $\text{invNorm}(0.23,700,45) = 666.752$ =VALUE 2

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ALL these problems are binomially distributed, to make an approximation using normal distribution adjustment of boundaries is necessary

$n = 200$ $p = 0.85$ $q = 1-0.85 = 0.15$

for approximating normal mean $= 200 \cdot 0.85 = 170$. SD $= \sqrt{200 \cdot 0.85 \cdot 0.15} = 5.04975$

11) P(between and including 173,178) = $P(45 \le x \le 51)$

binomial macro $=\text{binomCdf}(200, 0.85, 173, 178) = 0.275095$

normal macro $=\text{normCdf}(172.5, 178.5, 170, 5.05) = 0.264111$

12) P(less than 165) = $P(0 \le x \le 164)$

binomial macro $=\text{binomCdf}(200, 0.85, 0, 164) = 0.138733$

normal macro $=\text{normCdf}(-0.5, 164.5, 170, 5.05) = 0.138053$

13) P(between 170,179) = $P(171 \le x \le 178)$

binomial macro $=\text{binomCdf}(200, 0.85, 171, 178) = 0.428237$

normal macro $=\text{normCdf}(170.5, 178.5, 170, 5.05) = 0.414394$

Solutions to Quiz 1 Binomial and Normal Distributions 3−22−17 version 100

ALL these problems are binomially distributed, to make an approximation using normal distribution adjustment of boundaries is necessary

$n = 200$ $p = 0.85$ $q = 1-0.85 = 0.15$

for approximating normal mean $= 200 \cdot 0.85 = 170$. SD $= \sqrt{200 \cdot 0.85 \cdot 0.15} = 5.04975$

14) P(at least 177) = $P(177 \le x \le 200)$

binomial macro $=\text{binomCdf}(200, 0.85, 177, 200)$

normal macro $=\text{normCdf}(176.5, 200.5, 170, 5.05)$

15) P(exactly 175) = $P(x=175)$

binomial macro $=\text{binomPdf}(200, 0.85, 175) = 0.050804$

normal macro $=\text{normCdf}(174.5, 175.5, 170, 5.05) = 0.048388$

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16)

Question 1 find p such that when n=100 binomial can be approximated using normal

$np \geq 5$ is the key $\quad 100p \geq 5$

$$\frac{100p}{100} \geq \frac{5}{100}$$

$p \geq \frac{5}{100} = \frac{1}{20}$ So as long as $p \geq \frac{1}{20.}$ or $p \geq 0.05$

Question 2 find n such that when p=0.02 binomial can NOT be approximated using normal

$np \geq 5$ is the key $\quad 0.02n \geq 5$

$$\frac{0.02n}{0.02} \geq \frac{5}{0.02}$$ Note $250.$

$n \geq 250.$ will allow you to approximate binomial with normal

So as long as $n < 250.$ or n=249 is the largest size n that normal will not be allowed to approximate binomial