Learning Guide 19 Worksheet

9.4 Normal Distribution Approx. of the Binomial Distribution

Decide whether each binomial distribution situation can be reasonably approximated by a normal distribution. Give a reason for your yes or no answer. (n = # of trials, p = prob of success)

Example: $n = 10$, $p = 0.7$,
$q = 1 - p = 0.3$
$np = (10)(0.7) = 7$ $(np > 5)$
$nq = (10)(0.3) = 3$ $(nq < 5)$
No, because nq < 5

1. 8 trials, probability of success is 0.3.

2. 500 trials, probability of success is 0.05.

3. 25 trials, probability of failure is 0.75.

4. 5 trials, probability of success is 0.4.

5. 2000 trials, probability of success is 0.999.

Find the mean and standard deviation of the normal distribution approximating the given binomial distribution. (n = # of trials, p = prob of success)

Example: $n = 100$, $p = 0.7$,
$q = 1 - p = 0.3$
$np = (100)(0.7) = 70$ $(np > 5)$
$nq = (100)(0.3) = 30$ $(nq > 5)$
mean $= np = (100)(0.7) = $ **70**
st.dev. $= \sqrt{npq} = \sqrt{(100)(0.7)(0.3)} = $ **4.58**

6. 100 trials, probability of success is 0.2.

7. 500 trials, $q = 0.9$.

8. 2000 trials, probability of success is 0.05.

9. 400 trials, $q = 0.6$.

10. 20 trials, $p = 0.4$.

Find the continuity correction for each of the following situations.(n = # of trials)

Example: $n = 60$, P(5 successes)
cont.corr. $= 4.5$ to 5.5

Example: $n = 60$, P(at least 5 successes)
cont.corr. $= 4.5$ to 1E99

Example: $n = 60$, P(at most 5 successes)
cont.corr. $= $ -1E99 to 5.5

Example: $n = 60$, P(between 5 & 10 successes)
cont.corr. $= $ -4.5 to 10.5

11. $n = 20$, P(10 successes).

12. $n = 300$, P(5 failures).

13. $n = 250$, P(at least 120 successes).

14. $n = 75$, P(no more than 25 successes).

15. $n = 20$, P(at least 10 successes and no more than 15 successes).

16. $n = 50$, P(between 18 and 32 successes inclusive).

17. $n = 150$, P(greater than 50 and less than 125 successes).

Solve the following problems.

18. A multiple choice test consists of 25 questions and each question has four answers from which to choose. If a student guess every answer, use the normal approximation to the binomial distribution to find the probability that the student will:

    a. get exactly 5 questions correct?
    b. get more than 15 questions correct?
    c. will pass?

19. A baseball player's batting average is 0.275. Use the normal approximation to the binomial distribution to find the probability of getting 20 or more hits in the next 100 times at bat.

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20. The probability that a person is right handed is 85%. Use the normal approximation to the binomial distribution to find the probability that in a group of 100 people, between 70 and 90 are right handed.

21. The probability that a tire manufactured will be defective is 3%. Use the normal approximation to the binomial distribution to find the probability that with a random group of 300 tires, no more than 5 tires are defective?

22. If the failure rate of first year Calculus students is 30%, Use the normal approximation to the binomial distribution to find the probability that 6 or fewer students in a class of 25 will fail.

23. If 75% of all Canadian families have 1 or more cars, use the normal approximation to the binomial distribution to find the probability that is a random sample of 100 families, exactly 60 have one or more cars?

24. A machine produces glass jars of which 11% are defective. Use the normal approximation to the binomial distribution to find the probability that in a random sample of 1000 jars, exactly 110 will be defective?

25. A computer is used to simulate the rolling of a die 5000 times. Use the normal approximation to the binomial distribution to find the probability that in this simulation:

  a. more than 1000 ones will be rolled?
  b. more than 3000 prime numbers will be rolled?

9.5   Confidence Intervals

Identify the confidence interval implied and the margin of error in the following statements.

> Example: accurate within 5% 7 times out of ten.
>
> **Margin of Error** $=$ **5%**
> **Conf. Interval** $=$ 7/10 (**70%**)

26. 30% of Canadians watch baseball, with results accurate to within 2%, 19 times out of 20.

27. the life expectancy of smokers is five years less than non-smokers, 4 times out of 5, accurate to within 6 months.

28. 35% of students take Math 12, accurate to within 3.5%, 95% of the time

29. Kelsey students have an average mark of 74%, 3 times out of 4, accurate to within 2.4%

30. The average salary of Canadians is $26,095, 8 times out of 10, accurate to within $495.

Calculate the standard error for each of the following situations.

> Example: $n = 2500$, $p = 0.12$.
>
> **St. Error** $= \sqrt{\dfrac{pq}{n}} = \sqrt{\dfrac{(0.12)(0.88)}{2500}}$
> $= $ **0.0065**

31. $n = 2000$, $p = 0.3$.

32. $n = 200$, $p = 6\%$

33. 50 out of 200 people take Math 12.

34. 400 out of 2500 people take Driver Training.

35. $n = 500$, $p = 25\%$

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Is it reasonably approx. by a normal distribution?

1. No, $np < 5$.

2. Yes $np > 5$, $nq > 5$.

3. Yes $np > 5$, $nq > 5$.

4. No, $np < 5$, $nq < 5$.

5. No, $nq < 5$.

Find the mean and standard deviation.
6. $\mu = 20$, $\sigma = 4$

7. $\mu = 50$, $\sigma = 6.71$

8. $\mu = 100$, $\sigma = 9.75$

9. $\mu = 160$, $\sigma = 9.80$

10. $\mu = 8$, $\sigma = 2.19$

Find the continuity correction.

11. 9.5 - 10.5

12. 4.5 - 5.5 or 394.5 - 395.5

13. 119.5 - 1E99

14. -1E99 - 25.5

15. 9.5 - 15.5

16. 17.5 - 32.5

17. 50.5 - 124e.5

Word problems

18. a. 0.1551
b. 6.94E-5
c. 0.0019

19. 0.9634

20. 0.8962

21. 0.1181

22. 0.3313

23. 2.34E-4

24. 0.0403

25. a. 1.13×10^{-10}
b. 1.33×10^{-45}

Identify confidence interval and margin of error.

26. ci = 95%
me = 2%

27. ci = 80%
me = 6 months

28. ci = 95%
me = 3.5%

29. ci = 75%
me = 2.4%

30. ci = 80%
me = $495

Calculate the standard error

31. se = 0.0102

32. se = 0.0346

33. se = 0.0306

34. se = 0.0073

35. se = 0.0194