

Math Sheet

Name _____ Score _____ Teacher _____ Date _____

Geometric Distribution

Let X count trials through the first success, so X has support $1, 2, \dots$. Assume independent trials with constant success probability and round only final probabilities.

1. Let X count trials through the first success, with $p = 9/20$. Find the mean and population variance of X .

Assumptions: Trials are independent with constant success probability; X includes the successful trial and has support $1, 2, \dots$

2. Let X count trials through the first success, with $p = 1/4$. Find $P(X \geq 5)$, meaning at least 5 trials are required.

Assumptions: Trials are independent with constant success probability; X includes the successful trial and has support $1, 2, \dots$

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Let X count trials through the first success, so X has support $1, 2, \dots$. Assume independent trials with constant success probability and round only final probabilities.

3. Let X count trials through the first success, with $p = 11/20$. Find $P(X \leq 7)$, the first success by trial 7.

Assumptions: Trials are independent with constant success probability; X includes the successful trial and has support $1, 2, \dots$

4. Let X count trials through the first success, with $p = 3/10$. Find $P(X = 3)$.

Assumptions: Trials are independent with constant success probability; X includes the successful trial and has support $1, 2, \dots$

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Let X count trials through the first success, so X has support $1, 2, \dots$. Assume independent trials with constant success probability and round only final probabilities.

5. Let X count trials through the first success, with $p = 1/20$. Find $P(X = 2)$.

Assumptions: Trials are independent with constant success probability; X includes the successful trial and has support $1, 2, \dots$

6. Let X count trials through the first success, with $p = 17/20$. Find the mean and population variance of X .

Assumptions: Trials are independent with constant success probability; X includes the successful trial and has support $1, 2, \dots$

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Let X count trials through the first success, so X has support $1, 2, \dots$. Assume independent trials with constant success probability and round only final probabilities.

7. Let X count trials through the first success, with $p = 3/4$. Find $P(X \geq 9)$, meaning at least 9 trials are required.

Assumptions: Trials are independent with constant success probability; X includes the successful trial and has support $1, 2, \dots$

8. Let X count trials through the first success, with $p = 2/5$. Find $P(X \leq 6)$, the first success by trial 6.

Assumptions: Trials are independent with constant success probability; X includes the successful trial and has support $1, 2, \dots$

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Geometric Distribution

Worked Answer Key

Let X count trials through the first success, so X has support $1, 2, \dots$. Assume independent trials with constant success probability and round only final probabilities.

- 1.** Let X count trials through the first success, with $p = 9/20$. Find the mean and population variance of X .

Answer: mean 20/9, variance 220/81

1. $E(X) = 1/p = 20/9$ trials.
2. $\text{Var}(X) = (1-p)/p^2 = 220/81$ trials squared.

- 2.** Let X count trials through the first success, with $p = 1/4$. Find $P(X \geq 5)$, meaning at least 5 trials are required.

Answer: approximately 0.316

1. Reaching trial 5 requires failures on the first 4 trials.
2. $P(X \geq 5) = (1-1/4)^4$ is approximately 0.316.

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Geometric Distribution

Worked Answer Key

Let X count trials through the first success, so X has support $1, 2, \dots$. Assume independent trials with constant success probability and round only final probabilities.

- 3.** Let X count trials through the first success, with $p = 11/20$. Find $P(X \leq 7)$, the first success by trial 7.

Answer: approximately 0.996

1. Use the complement of 7 consecutive failures.
2. $P(X \leq 7) = 1 - (1 - 11/20)^7$ is approximately 0.996.

- 4.** Let X count trials through the first success, with $p = 3/10$. Find $P(X = 3)$.

Answer: approximately 0.147

1. There are 2 failures followed by one success.
2. $P(X=3) = (1 - 3/10)^2 (3/10)$ is approximately 0.147.

Geometric Distribution

Worked Answer Key

Let X count trials through the first success, so X has support $1, 2, \dots$. Assume independent trials with constant success probability and round only final probabilities.

5. Let X count trials through the first success, with $p = 1/20$. Find $P(X = 2)$.

Answer: approximately 0.048

1. There are 1 failures followed by one success.
2. $P(X=2) = (1-1/20)^1(1/20)$ is approximately 0.048.

6. Let X count trials through the first success, with $p = 17/20$. Find the mean and population variance of X .

Answer: mean 20/17, variance 60/289

1. $E(X) = 1/p = 20/17$ trials.
2. $\text{Var}(X) = (1-p)/p^2 = 60/289$ trials squared.

Geometric Distribution

Worked Answer Key

Let X count trials through the first success, so X has support $1, 2, \dots$. Assume independent trials with constant success probability and round only final probabilities.

7. Let X count trials through the first success, with $p = 3/4$. Find $P(X \geq 9)$, meaning at least 9 trials are required.

Answer: approximately 1.526e-5

1. Reaching trial 9 requires failures on the first 8 trials.
2. $P(X \geq 9) = (1 - 3/4)^8$ is approximately 1.526e-5.

8. Let X count trials through the first success, with $p = 2/5$. Find $P(X \leq 6)$, the first success by trial 6.

Answer: approximately 0.953

1. Use the complement of 6 consecutive failures.
2. $P(X \leq 6) = 1 - (1 - 2/5)^6$ is approximately 0.953.