Probability Models

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

List every outcome once. Probabilities must be nonnegative and total 1; for instance $0.2 + 0.3 + 0.5 = 1$. Group repeated labels before reporting the model. For trial data, divide each count by the total number of trials.

Worked example

Five equally likely slips are labeled X, X, Y, Z, Z. Build the label model.

1. One slip has probability $1/5$.
2. X and Z each use 2 slips: $P(X) = P(Z) = 2/5$. Y uses one: $P(Y) = 1/5$.
3. Check the total: $2/5 + 1/5 + 2/5 = 1$.
Answer: X: $2/5$, Y: $1/5$, Z: $2/5$.

Practice Problems

Show your thinking.

1. The table shows all outcomes. Complete it and find $P(A \text{ or } C)$.

Outcome	Probability
A	$1/4$
B	$1/2$
C	?

2. A spinner has four equal sectors labeled R, R, B, G. Give one probability for each distinct color and check the total.

3. Use the trial tally to build an experimental probability model and verify its total.

Outcome	Count
A	9
B	6
C	5

4. Can $2/5, 2/5, 2/5$ be the probabilities of three exhaustive outcomes? Find the excess and repair only the third entry.

5. A bag has 20 equally likely counters. To give red probability $3/5$, how many must be red and how many nonred?

6. Game A wins with chance $2/5$ and B with chance $3/8$. Which chance is greater and by how much? Find expected wins in 40 plays of each.

7. The only outcomes are L, M, N, with probabilities 0.35, $1/4$, and 40%, respectively. Verify the model and rank outcomes by probability.

8. A spinner with a uniform pointer has area shares $1/2$ red, $1/3$ blue, and $1/6$ green. Write its probability model and verify the total.

Answer Key

1. $P(A) = 1/4$, $P(B) = 1/2$, $P(C) = 1/4$; $P(A \text{ or } C) = 1/2$.
2. $P(R) = 1/2$, $P(B) = 1/4$, $P(G) = 1/4$.
3. $P(A) = 9/20$, $P(B) = 3/10$, $P(C) = 1/4$.
4. No; excess $1/5$. The third entry should be $1/5$.
5. 12 red and 8 nonred.
6. A by $1/40$; expected wins: A 16, B 15.
7. Valid; from greatest to least: N, L, M.
8. Red: $1/2$; blue: $1/3$; green: $1/6$. Total 1.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The two given entries total $1/4 + 1/2 = 3/4$.
2. Fill the blank with $P(C) = 1 - 3/4 = 1/4$.
3. The outcomes do not overlap: $P(A \text{ or } C) = 1/4 + 1/4 = 1/2$.

Problem 2

1. Each of the 4 equal sectors has probability $1/4$.
2. Two red sectors give $P(R) = 2/4 = 1/2$. Blue and green each have one sector: $P(B) = P(G) = 1/4$.
3. The three color probabilities sum to $1/2 + 1/4 + 1/4 = 1$.

Problem 3

1. Total trials: $9 + 6 + 5 = 20$.
2. Divide by 20: A is $9/20$, B is $6/20 = 3/10$, and C is $5/20 = 1/4$.
3. The model totals $(9 + 6 + 5)/20 = 1$.

Problem 4

1. The proposed total is $2/5 + 2/5 + 2/5 = 6/5$.
2. That exceeds 1 by $6/5 - 1 = 1/5$.
3. Keep the first two entries: the third must be $1 - 4/5 = 1/5$.

Problem 5

1. Red count: $20(3/5) = 12$.
2. The rest are nonred: $20 - 12 = 8$.
3. Check the red chance: $12/20 = 3/5$.

Problem 6

1. Use a common denominator: $2/5 = 16/40$ and $3/8 = 15/40$.
2. A has the larger chance by $16/40 - 15/40 = 1/40$.
3. Expected wins are $40(2/5) = 16$ and $40(3/8) = 15$.

Problem 7

1. Express all three in hundredths: $35/100$, $25/100$, and $40/100$.
2. The total is $(35 + 25 + 40)/100 = 1$ and all entries are nonnegative.
3. Compare the numerators: $40 > 35 > 25$, so N is most likely and M least likely.

Problem 8

1. With a uniform pointer, each color probability is its share of the circle: $1/2$, $1/3$, and $1/6$.
2. Use sixths: red is $1/2 = 3/6$, blue is $1/3 = 2/6$, and green stays $1/6$.
3. Check the total: $(3 + 2 + 1)/6 = 1$.

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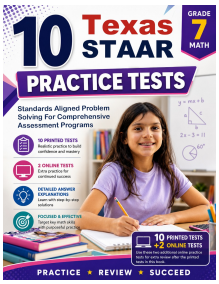

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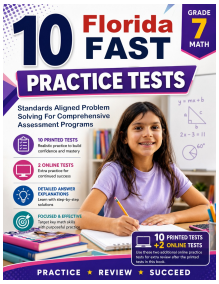

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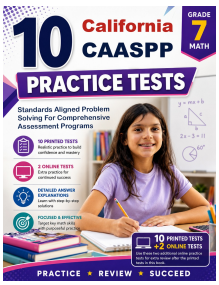

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