Experimental Probability

Apply the skill to decisions and designs

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

QUICK REVIEW

Experimental probability is the observed event count divided by the total trials. For 11 hits in 25 trials, the observed rate is $11/25$. Multiply the rate by the new trial count to predict under similar conditions. The result is not guaranteed.

Worked example

A spinner lands red 12 times in 30 trials. Estimate red results in 160 similar trials.

1. Observed rate $12/30 = 2/5$.
2. The projected red count is $160(2/5) = 64$.
3. It is an estimate from past trials; a new run need not produce exactly 64.
Answer: About 64 red results.

Practice Problems

Show your thinking.

1. A machine ran 20 trials before a repair and passed 11. After the repair it ran 30 trials and passed 27. Which observations should estimate its current pass rate? Compute that rate and the pooled rate to explain the difference.

2. A booth is tested and awards 29 prizes in 60 plays. About how many prizes should it prepare for 200 similar plays? It has 90 prizes. Compare that stock with the estimate, rounding the estimate to the nearest prize.

3. A coin test gives 12 heads in 20 tosses. A second test of the same coin gives 8 heads in 20. Find the separate head rates and the combined rate. Does the combined result prove the next toss will be tails?

4. A lot passes 42 of 50 quality tests. The rule says to retest when more than $1/10$ fail. Find the observed failure rate and decide whether to retest.

5. Choose a booth by success rate: A has 24 of 80, B has 28 of 100. Calculate both rates and their difference.

6. A report plans from rate $\frac{19}{45}$ across 90 tests. Recover the observed count and state why scaling to new trials remains an estimate.

7. Tests give 7 wins in 20 plays and 9 in 30. Use pooled probability to estimate prizes for 125 new plays.

8. An observed success rate is $3/8$. How many planned trials give an expected 96 successes? State why the count is a prediction.

Answer Key

1. Use after-repair data: $9/10$. Pooled across both: $19/25$.
2. About 97 prizes; the stock is 7 short of the estimate.
3. $3/5$, $2/5$, combined $1/2$; no prediction of the exact next result.
4. Failure rate $4/25$; retest.
5. A $\frac{3}{10}$, B $\frac{7}{25}$; A is higher, gap $\frac{1}{50}$.
6. 38 successes.
7. About 40 prizes, not a guaranteed count.
8. 256 planned trials; expected, not guaranteed, 96 successes.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. For the current machine, use the 30 trials after the repair. The pass rate is $27/30 = 9/10$.

2. Pooling both versions gives $(11 + 27)/(20 + 30) = 38/50 = 19/25$.

3. That pooled rate mixes two conditions. It need not describe the repaired machine alone.

Problem 2

1. The observed rate is $29/60$.

2. The model gives $200(29/60) = 290/3$, about 97 prizes.

3. The stock is $97 - 90 = 7$ short of the estimate. The actual number of wins may differ.

Problem 3

1. The first rate is $12/20 = 3/5$; the second is $8/20 = 2/5$.

2. Combine the counts: $(12 + 8)/(20 + 20) = 20/40 = 1/2$.

3. The fraction describes these trials. It does not force the next toss to be tails or heads.

Problem 4

1. Failures $= 50 - 42 = 8$.

2. Observed failure rate $= 8/50 = 4/25$.

3. The limit $1/10$ is $5/50$. Since $8/50 > 5/50$, retest.

Problem 5

1. Observed win rates: A $24/80 = \frac{3}{10}$; B $28/100 = \frac{7}{25}$.

2. With denominator 50, A is $15/50$ and B is $14/50$, so A is higher.

3. Subtract the smaller rate from the larger: $15/50 - 14/50 = 1/50$.

Problem 6

1. The unknown count s satisfies $s/90 = \frac{19}{45}$.

2. Multiply by the total: $s = 90(\frac{19}{45}) = 38$.

3. Check: $38/90 = \frac{19}{45}$. New trials can produce a different rate, so the old count does not guarantee a future result.

Problem 7

1. Wins $7 + 9 = 16$, plays $20 + 30 = 50$.

2. Pooled probability $16/50 = 8/25$.

3. Projection $125(8/25) = 40$ wins; future outcomes may differ.

Problem 8

1. At rate $3/8$, the expected successes in N trials are $(3/8)N$.

2. Set $(3/8)N = 96$, then divide: $N = 96/(3/8) = 256$.

3. Check $256(3/8) = 96$. A future experiment may have a different rate, so this count is not guaranteed.

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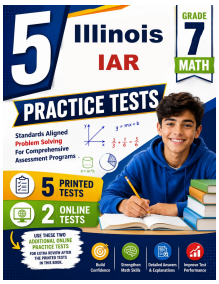

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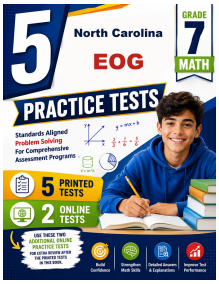

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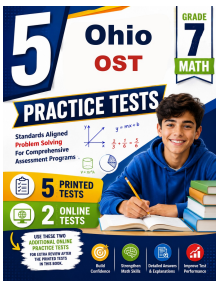

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