Rubric: A lucky Draw

Key APS Mathematics Content and Performance Standards:

Target Performance Standards – Grade 5

1. **Performs** simple probability experiments and **organizes** data in a useful way:
   - ✓ **identifies** patterns,
   - ✓ **predicts** outcomes, and
   - ✓ **explains** effects on outcomes when a probability experiment is conducted several times.
2. **Explains** the fairness of games and outcomes of events using knowledge of probability concepts.
3. **Explains** that the measure of the likelihood of an event can be represented by a number from 0 to 1 (e.g., If you flip a coin, you have ½ chance of getting either heads or tails.).

- If the student does not attempt to solve the task or the work on the problem is completely unrelated to the task, the student's work for the task is considered **"Unscorable"** and should not be assigned a performance level of Novice, Apprentice, Practitioner, or Expert.

Level	Understanding	Strategies, Reasoning, & Procedures	Communication
Novice	❖ The student understands that the task is a multiple step problem, but does not have the mathematical knowledge to complete the task and will only attempt to solve 1 or 2 aspects of the problem. ❖ The student understands that the task is dealing with the concept of probability, but does not have enough experience to conduct a theoretical and/or experimental probability. ❖ The student understands that they need to identify possible outcomes of the event, but cannot list all of the outcomes. ❖ The student understands that they need to give John advice about playing the game, but cannot accurately interpret the outcomes of the event.	❖ The student attempts to use <u>either</u> theoretical or experimental probability to solve the task, but does not understand enough about probability to address all of the steps needed to solve the task. **Sample Strategy:** **Step 1:** Lists possible outcomes, but the list is incomplete. **Step 2:** Begins an experimental probability experiment, but does not accurately track their results. **Step 3:** Advises John about the game, but the advice is not based on accurate probability results.	❖ There is little or no communication, the student did not label the work, and/or their thinking is difficult to follow. ❖ **Summary:** The student does not write his/her final answer, and/or uses little or no mathematical language and symbols to explain how s/he calculated and advised John on the probability of pulling a Green-Green block combination from the bag. ❖ **Representations:** The student has no system (charts/t-tables/graphs) to track the calculations for all the possible outcomes of the event, the results of the experimental probability experiment, <u>and/or</u> the results of the theoretical probability.

Apprentice	❖ The student understands that the task is a multiple step problem, but cannot use the information at each of the steps to progress the problem. ❖ The student understands that they must: • Calculate probability. • Conduct theoretical and/or experimental probability, but may not be able to accurately compute the calculations. • Identify possible outcomes of an event, but may not list all of the outcomes. • Interpret probability outcomes of an event.	❖ The student has started the task using manipulatives or representations, has chosen a strategy to solve the task, but does not achieve a correct solution. ❖ The student may not know how to address all of the aspects of the task or may get an incorrect answer due to computation errors. ❖ The student attempts to use <u>either</u> theoretical or experimental probability to solve the task. **Sample Strategy:** **Step 1:** Identifies possible outcomes. **Step 2:** Conducts an experimental probability experiment. Records results, but does not know how to interpret the information. (i.e., Green-Green came up 20/100 times.) **Step 3:** Gives John advice. "Try it and see if you win."	❖ The student has communicated his/her understanding of the task by labeling their work, but the task is not clearly organized and the student's thinking is hard to follow. ❖ **Summary:** The student states his/her final answer; and uses some mathematical language and symbols to explain (in writing) how s/he calculated and advised John on the probability of pulling a Green-Green block combination from the bag. ❖ **Representations:** The student has not established an accurate system (charts/t-tables/graphs) to track the calculations for all the possible outcomes of the event, the results of the experimental probability experiment, <u>and/or</u> the results of the theoretical probability.

Scoring Note: To score an apprentice on this assessment the student needs to have an understanding of either theoretical or experimental probability.

Practitioner	**Proficiency** ❖ The student understands that the task is a multiple step problem and that the answer at each step, progresses the problem. ❖ The student understands how to: • Calculate probability. • Conduct theoretical and/or experimental probability. • Identify all possible outcomes of an event. • Interpret probability outcomes of an event.	**Proficiency** ❖ The student uses one effective strategy to correctly solve all of the steps of the task. ❖ The student uses <u>either</u> theoretical or experimental probability to solve the task. ❖ Task calculations include: • Identifying all 12 of the outcomes, either through a list of combinations or a tree diagram. • Calculating the theoretical probability (2/12) of pulling a Green-Green combination from the bag. ***<u>OR</u>*** • Performing an experimental probability experiment to verify their results. • Interpreting the probability of John pulling a Green-Green combination through the advice the student gives to John. (2/12: means that in 12 tries John will most likely pull the Green-Green twice.) **Sample Strategy:** (See 'Possible Solutions' in the *Teacher Instructions* for complete solutions and strategies.)	**Proficiency** ❖ The student can represent his/her work in a clear, organized manner. ❖ **Summary:** The student uses appropriate mathematical language and symbols to explain (in writing) how s/he calculated and advised John on the probability of pulling a Green-Green block combination from the bag. ❖ **Representations:** The student has created an efficient system (charts/t-tables/graphs) to track the calculations for all the possible outcomes of the event, the results of the experimental probability experiment, <u>and/or</u> the results of the theoretical probability.

Scoring Note: To score a practitioner on this assessment the student <u>must</u> support their answer to John with an accurate theoretical or experimental probability.

Expert	❖ The student understands that the task is a multiple step problem, and that the answer at each step, progresses the problem. ❖ The student understands how to: • Calculate probability. • Conduct theoretical and/or experimental probability. • Identify all possible outcomes of an event. • Interpret probability outcomes of an event. ❖ **Task Extension:** The student extends the task by including a written rule, equation, generalization, or observation about their understanding of probability.	❖ The student uses more than one accurate and appropriate strategy to solve all of the steps of the task. ❖ The student uses <u>both</u> theoretical and experimental probability to solve the task. ❖ Task calculations include: • Identifying all 12 of the outcomes, either through a list of combinations or a tree diagram. • Calculating the theoretical probability (2/12) of pulling a Green-Green combination from the bag. • Performing an experimental probability experiment to verify their results. • Interpreting the probability of John pulling a Green-Green combination through the advice the student gives to John. (2/12: means that in 12 tries John will most likely pull the Green-Green twice.) **Sample Strategy:** (See 'Possible Solutions' in the *Teacher Instructions* for complete solutions and strategies.) ❖ **Task Extension:** I compared the results of the theoretical and experimental probability and realized that the probability 2:12 for pulling a Green-Green combination are accurate. The game is not fair for the participant.	❖ The student can represent his/her work in a clear, organized manner. ❖ **Summary:** The student uses appropriate mathematical language and symbols to explain (in writing) how s/he calculated and advised John on the probability of pulling a Green-Green block combination from the bag. ❖ **Representations:** The student has created an efficient system (charts/t-tables/graphs) to track the calculations for all the possible outcomes of the event, the results of the experimental probability experiment, <u>and</u> the results of the theoretical probability. ❖ **Task Extension:** The student includes a written rule, equation, generalization, and/or observation about their mathematical insights about their understanding of probability.

Scoring Note: To score an expert on this assessment the student <u>must</u> perform both theoretical and experimental probabilities, but does not necessarily have to extend the task.