Secondary 2 Mathematics · Practice Worksheet · tutorinmontreal.ca

Probability

Name: ______________________________ Date: ______________

Concepts

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Modes of Representation and the Enumeration of Possible Outcomes

1. A bubble tea counter in Rosemont prepares one drink at random for a taste test. It picks one tea — green, black, taro or mango — then one topping — tapioca, jelly or none — then one size — small or large.

a) How many different drinks are possible? Show the calculation.

b) Explain why a two-column table is awkward for this experiment, and say which mode of representation you would use instead.

c) List every possible drink that uses green tea, writing each one as a triple such as (green, jelly, large).

Probability

2. A board game uses a spinner with 8 sectors, all the same size: 4 sectors say *advance 1*, 2 say *advance 2*, 1 says *advance 3* and 1 says *lose a turn*.

a) Explain why the 8 sectors give 8 equally likely outcomes.

b) Find $P(\text{advance 2})$ as a fraction in lowest terms, as a decimal and as a percentage.

c) Find the probability that the player advances at all.

d) A game lasts 200 spins. About how many times should a player expect *lose a turn*? Is that number guaranteed?

Random Experiments Where Order Matters and Where Order Does Not Matter

3. A cycling club has five members: Alix, Bao, Camille, Dilan and Élodie. Use their initials A, B, C, D, E.

a) Three of them are picked to ride a relay, and the order of the picking does not matter. List every possible team, in alphabetical order, and count them.

b) Instead, three of them are picked as first rider, second rider and third rider, so the order does matter. How many possibilities? Show the calculation.

c) Divide the answer to b) by the answer to a), and explain in words what that number counts.

Random Experiments With One or More Steps

4. A two-step game rolls a fair six-sided die numbered 1 to 6, then spins a spinner with four equal sectors numbered 1 to 4. The two numbers are added.

a) How many equally likely results does the game have? Build a table showing the total for each of them.

b) Find the probability that the total is exactly 5.

c) Find the probability that the total is 9 or more.

Random Experiments With and Without Replacement

5. A jar holds 6 keychains: 4 blue (B_1, B_2, B_3, B_4) and 2 orange (O_1, O_2). Two keychains are taken.

a) The first is *not* put back. Treating the two keychains as an unordered pair, how many pairs are possible, and what is $P(\text{both blue})$?

b) The first *is* put back and the results are written in order. How many results are possible now, and what is $P(\text{both blue})$?

c) Which version makes “both blue” more likely? Explain why, using the contents of the jar.

Sample Space

6. Three roommates — Ana, Ben and Coralie — draw lots for three different chores: dishes (D), recycling (R) and sweeping (S). Each person ends up with exactly one chore, and no chore is given twice.

a) Write the sample space Ω, using a triple such as $(\mathrm{D}, \mathrm{R}, \mathrm{S})$ to mean “Ana gets dishes, Ben gets recycling, Coralie gets sweeping”.

b) Explain why this is a draw *without* replacement, and how that shows in the size of Ω.

c) Find $P(\text{Ana gets the dishes})$ and $P(\text{Ben gets recycling and Coralie gets sweeping})$.

The Concept of "Or" and "And" in Probability

7. A bag holds 6 tiles: $A1$, $A2$, $A3$, $B1$, $B2$, $B3$. One tile is drawn at random. Let E be "the tile has the letter A" and F be "the tile has an odd number".

a) List the outcomes of E and the outcomes of F.

b) Find $P(E \text{ and } F)$.

c) Find $P(E \text{ or } F)$, then check your answer with $P(E) + P(F) - P(E \text{ and } F)$.

d) Give an event of this experiment that is incompatible with E.

The Intersection and Union of Sets

8. Thirty students were asked about three activities: skating (S), music lessons (M) and volunteering (V). The survey found 15 skaters, 12 in music lessons and 9 volunteers; 5 students do skating and music, 4 do skating and volunteering, 3 do music and volunteering, and 2 do all three. Each of those three pair counts includes the students who do all three activities.

a) Draw a Venn diagram with three overlapping circles and write the correct number in each of its eight regions. Start from the centre.

b) Find the probability that a randomly chosen student does exactly one of the three activities.

c) Find the probability that a randomly chosen student does none of them.

The Types of Probability - Secondary 1 and 2

9. A thumbtack dropped on a table lands either point-up or point-down. Camille drops one 400 times and records 244 landings point-up.

a) Find the experimental probability that the thumbtack lands point-up. Give it as a decimal and as a percentage.

b) Camille's classmate says the theoretical probability must be $\frac{1}{2}$, "since there are two ways to land". Explain why no theoretical probability can be found for this experiment.

c) Predict about how many point-up landings there would be in 1000 drops.

Types of Events - Secondary 1 and 2

10. Twenty-four tiles numbered 1 to 24 are placed in a bag and one is drawn at random.

a) For each event below, give its probability and name the most precise type that applies, choosing from *certain*, *impossible*, *elementary* and *probable*:
A: the number is a multiple of 6; B: the number is greater than 24;
C: the number is 13; D: the number is less than 25.

b) Let E be "the number is odd". Are A and E compatible? Justify.

c) Is E complementary to "the number is even"? Check both conditions.

d) Name an event that is incompatible with D, and explain why every such event must be impossible.

Synthesis — drawing on several sheets in this topic

11. A gym bin holds 6 balls: 2 blue (B_1, B_2) and 4 white ($W_1, \dots, W_4$). Two balls are taken out one after the other and the order is recorded.

a) Explain why labelling the balls, rather than just calling them "blue" and "white", is what makes the outcomes equally likely.

b) Without replacement: how many results are in the sample space, and what is the probability of getting one ball of each colour?

c) With replacement: answer the same two questions.

d) In which version is "one of each colour" more likely? Explain why, using what is in the bin at the second draw.