

2.4.2 Conditional Probability⁷

Description	Conditional Probability (2 days)
Core Math	<ul style="list-style-type: none"> - Represent events as a subset of a sample space using tables and tree diagrams. - Understand conditional probability.
CCSS-M Standard(s)	S-CP Understand independence and conditional probability and use to interpret data
Standards for Mathematical Practices	MP 1: Make Sense and Persevere MP 2: Reason Abstractly and Quantitatively MP 3: Construct Viable Arguments and Critique the Reasoning of Others MP 4: Model with Mathematics MP 7: Look for and Make Use of Structure
Resources and Setup	<ul style="list-style-type: none"> • Each student will need a copy of the <i>Lucky Dip</i> assessment task, the <i>How Did You Work?</i> questionnaire, a mini-whiteboard, pen, and eraser. • Each small group of students will need a large sheet of paper for making a poster, a felt-tipped pen, and enlarged copies of the <i>Sample Responses to Discuss</i>. • You will need a bag and some black and white balls (or some substitute) for a class demonstration. • Poster paper, markers and enlarged copies of <i>Sample Responses to Discuss</i> for each small group • Document camera or LCD projector and computer <p>There is a projector resource to support whole-class discussion. http://map.mathshell.org/lessons.php?unit=9425&collection=8</p>

⁷Source: Mathematics Assessment Project

<http://map.mathshell.org/lessons.php?unit=9425&collection=8>

Lesson	
Launch 20 min	Day 1 <ul style="list-style-type: none"> - Begin lesson by introducing the task context. - Show slide and hand out “<i>Lucky Dip</i>”. - Discuss the rules – you could demonstrate the game using a bag and some balls.
Instructional Activities 30 min	<ul style="list-style-type: none"> - Organize the class into small groups of two or three students. Give each group a large piece of paper and a felt-tipped pen. - Have students collaborate to plan a joint solution. Encourage them to consider varied approaches and develop a poster with a well-articulated joint solution. - As students complete task, note different student approaches to the task and to support student problem solving. - Use guiding questions to help struggling students.
Share	<ul style="list-style-type: none"> - Have students do a Gallery walk, 1 expert from each group can stay with the poster to explain while the rest of the group visits other posters. - Encourage students to compare solutions and notice different groups’ approaches / assumptions. Discuss variations. - If no time, do this next day.
Summarize	Save work for next class
Launch 10 min	Day 2: <ul style="list-style-type: none"> - Have students get back into their groups and review their work. - Allow students time to familiarize themselves with their joint solution and discuss other approaches before moving on to the collaborative analysis of sample responses.
Instructional Activities 30 min	<ul style="list-style-type: none"> - Provide sample responses and have each group respond to the prompts from <i>Evaluating Sample Responses to Discuss</i>. - Encourage students to explain what the students in the samples did, what mistakes they made, and write questions about what is not clear about the work. - Monitor students as they work, note methods students have difficulty understanding.
Share 10 min	<ul style="list-style-type: none"> - Lead whole class discussion of the three approaches. - Focus discussion on parts of the task students found difficult. Ask the students to compare the different

	<ul style="list-style-type: none">- solution methods:<ul style="list-style-type: none">○ Which approach did you like best? Why?○ Which approach did you find most difficult to understand? Why?
Summarize	<ul style="list-style-type: none">- Make sure students understand the flaws in each approach and the correct way to find the solution
Universal Support	Be sure to group students heterogeneously
Extensions	Representing Conditional Probabilities 2 http://map.mathshell.org/lessons.php?unit=9430&collection=8
Homework	Give How did you Work? as a homework assignment

Lucky Dip

Dominic has devised a simple game.
Inside a bag he places 3 black and 3 white balls. He then shakes the bag.

He asks Amy to take two balls from the bag without looking.

Dominic



If the two balls are the same color then you win.
If they are different colors then I win.

OK.
That sounds fair to me.



Amy

Is Amy right? Is the game fair?

If Amy is wrong, then who is most likely to win?

Show all your reasoning clearly.



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Planning a Joint Solution

1. Take turns to explain how you did the task and how you now think it could be improved.
2. Listen carefully to explanations.
 - Ask questions if you don't understand.
 - Discuss with your partner(s):
 - What you like/dislike about your partner's math.
 - Any assumptions your partner has made.
 - How their work could be improved.
3. Once everyone in the group has explained their solution, plan a joint approach that is better than each of the separate solutions.
 - On the second side of your poster or paper write a couple of sentences outlining your plan.

Evaluating Sample Responses to Discuss

1. Imagine you are the teacher and have to assess the student work.
2. Take turns to work through a students' solution.
 - Write your answers on your mini-whiteboards.
3. Explain your answer to the rest of the group.
4. Listen carefully to explanations.
 - Ask questions if you don't understand.
5. Once everyone is satisfied with the explanations, write the answers below the students' solution.
 - Make sure the student who writes the answers is not the student who explained them.

Sample Responses to Discuss: Anna

Amy could select
Black + black
Black + white
White + black
White + white

There are 2 when the balls
are the same color + 2
when the balls are different

THE GAME IS FAIR

Explain what the student has done. _____

What isn't clear about her work? _____

What mistakes has she made? _____

Sample Responses to Discuss: Ella

		2nd ball			W1	W2	W3	
		B1	B2	B3				
1st ball	B1	Amy	A	A	D	D	D	
	B2	A	A	A	D	D	D	
	B3	A	A	A	D	D	D	
		W1	W2	W3	D	D	D	
		W1	D	D	D	A	A	A
		W2	D	D	D	A	A	A
		W3	D	D	D	A	A	A

There are 36 equally likely outcomes.

Amy wins 18 times

Dominic wins 18 times

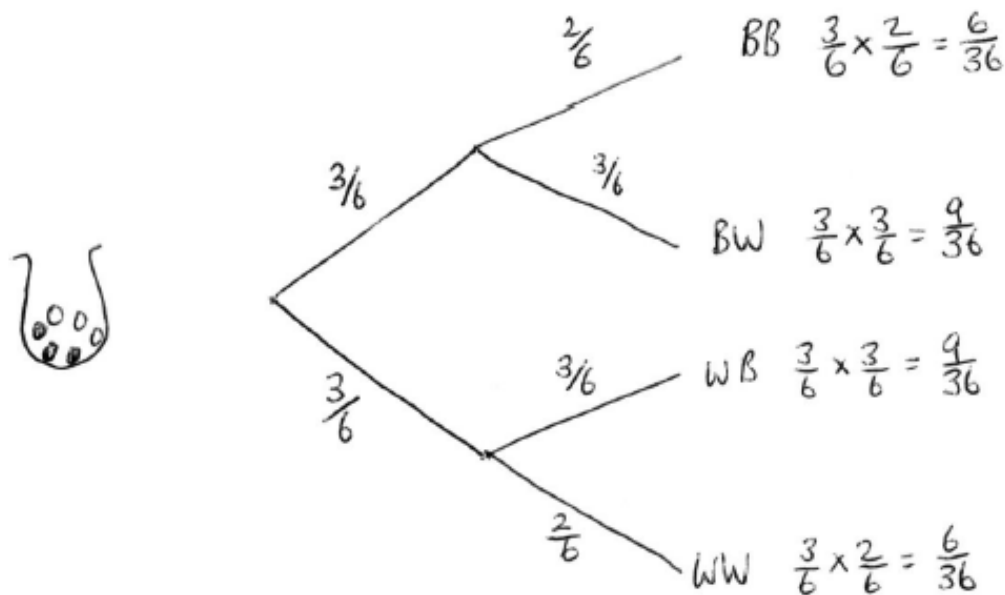
So the game is fair.

Explain what the student has done.

What isn't clear about her work?

What mistakes has she made?

Sample Responses to Discuss: Jordan



2 same color = $\frac{6}{36} + \frac{6}{36} = \frac{12}{36} = \frac{1}{3}$

2 different color = $\frac{9}{36} + \frac{9}{36} = \frac{18}{36} = \frac{1}{2}$

Explain what the student has done. _____

What isn't clear about his work? _____

What mistakes has he made? _____

How Did You Work?

1. Compare the sample responses and your group response. What are the advantages and disadvantages of each approach?

	Advantages	Disadvantages
Amy		
Ella		
Jordan		
Our group work		

2. Now that you have seen Amy's, Ella's and Jordan's work, what would you do if you started the task again?

3. What do you think are the difficulties someone new to the task will face?
