

## WHAT'S IN THE BAG?

### Performance Standard 10C.E

Determine how many red and yellow links are in a bag based on data collected from three trials of ten draws each where one link is drawn from a bag at a time and replaced accordingly:

- *Mathematical knowledge:* determine, describe and apply the probabilities of events,
- *Strategic knowledge:* use strategies appropriately to determine the number of red and yellow links in the bag, and
- *Explanation:* explain completely and clearly what was done and why it was done.

### Procedures

1. ***In order to determine, describe, and apply the probabilities of events (10C)***, students should experience sufficient learning opportunities to develop the following:
  - Assign a value of 0 to probabilities that are impossible and a value of 1 to probabilities that are certain.
  - Express simple probabilities as a fraction between zero and one.
  - Predict the probability of outcomes of simple experiments and test the predictions.
2. Provide each student with a copy of the “What’s in the Bag” recording sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Review vocabulary (e.g., with and without replacement, certain, impossible) as you begin. You can do this by showing the students the bags and telling them there are 30 links (or whatever objects you use) in each bag and some are yellow and some are red. Ask, “What is the probability of drawing a purple link? (Impossible) How would you record the probability of drawing a purple link? (0/30) What is the probability of drawing a red or yellow link? If we draw and don’t put the link back, it’s called what? If we draw and put the link back it’s called what?” Then ask, “What are the possible combinations of links we could have?” If the first answer is some combination other than addends that are multiples of five, stop and say, “I forgot to give you one more clue. The combinations have to be in multiples of 5. Now what could be in the bags?” They should list the five combinations. The teacher needs to record the 5 possible combinations on the board or overhead transparency. This should be done by drawing 5 bags and labeling the bags A, B, C, D, E. Place one combination next to each bag. Students need to see what combination may be in what bag to make their predictions. Example: If Bag A is 15 Red and 15 Yellow and one group draws 5 red and 5 yellow during their first trial, that group might predict they have Bag A. During the next trial that group may draw 6 red and 4 yellow. This may cause them to change their prediction to Bag D which has 20 red and 10 yellow or they might keep the same prediction, Bag A. If someone asks about there being more than five bags, tell them some of the combinations are repeated.
4. Divide the class into groups of 3 and provide each group with a bag of 30 links. Explain in each group there are three jobs: shaker, drawer, and tally person. Tell them that they will do 3 trials so each person will do each job.
5. During the first trial (and subsequent trials after jobs have been rotated) the shakers shake the closed bag a couple of times. The drawer then draws one link out of the bag (no one in the group is to peek inside the bag) and the tally person records whether it is red or yellow. The drawer puts the link back in the bag. Do this 10 times and stop.
6. Record each group’s data on the overhead. Ask each group to look at their data as well as the data of the other groups and predict which bag they think they have. The shaker should come up and write his/her group’s prediction on the overhead. While the prediction is being recorded the tally person needs to write a brief justification of the group’s prediction explaining why the group predicted the bag they did. Example: “Because we drew 7 yellows and 3 reds we think we have Bag B. Bag B has 20 yellow and 10 red. That is twice as many yellows as reds. We drew a little more than twice as many yellows as reds.”
7. Do the second trial and record the data on the overhead. Have each group discuss the data that is displayed for trial number 2 and predict which bag they think they have based on the second trial only. Has the prediction changed from the first trial? Why? Once again the shaker should record the prediction on the overhead and the tally person should write a justification for the group’s prediction.
8. Change jobs as they did for the second trial and do the third trial as they did the first and second trials. Record data, make and record prediction, and write justification for prediction.
9. Now have them add to get the total number of red and the total number of yellow from all three trials and one person from the group needs to record it on the overhead. Each student will begin the written portion of the

assessment here. Each student now needs to use the data collected by his/her group to make a prediction about what is in the group's bag. Each student must write a justification that explains his/her prediction.

10. After each student has finished writing his/her prediction and justification, have one student in each group empty the bag on the desk to verify the contents. Each student then continues the written part of the assessment by telling whether his/her prediction matched the actual contents. If the student's prediction does not match the actual contents, the student should explain in writing why this might have occurred.
11. Evaluate each student's work using the rubric and the guide on the rubric to determine the performance level. This is an assessment that could be videotaped so the discussion can be assessed as well as the writing. Since the students are working in groups, the teacher will need to circulate and make notes about the discussion going on in each group. Students should be using terminology pertaining to probability. They should be predicting on the basis of number of each color drawn compared to possible contents.

### **Examples of Student Work follow**

#### **Time Requirements**

- One class period

#### **Resources**

- Copies of "What's In the Bag?" recording sheet
- Two colors of plastic links (centimeter cubes, color tiles, or counters could be used as well)
- Overhead transparency of data collection chart
- One bag per three students (Yellow and red are used as an example and for clarification.)  
Bag A -- 15 Y & 15 R ; Bag B -- 20 Y & 10 R  
Bag C -- 25 Y & 5 R ; Bag D -- 10 Y & 20 R  
Bag E -- 5 Y & 25 R; Repeat pattern for additional bags, but continue Bag F, and so on
- Mathematics Rubric

NAME \_\_\_\_\_ DATE \_\_\_\_\_

**WHAT'S IN THE BAG?**

Student Recording Sheet

	Trial #1	Prediction	Trial #2	Prediction	Trial #3	Prediction	Total	Prediction
Group 1	R:		R:		R:		R:	
	Y:		Y:		Y:		Y:	
Group 2	R:		R:		R:		R:	
	Y:		Y:		Y:		Y:	
Group 3	R:		R:		R:		R:	
	Y:		Y:		Y:		Y:	
Group 4	R:		R:		R:		R:	
	Y:		Y:		Y:		Y:	
Group 5	R:		R:		R:		R:	
	Y:		Y:		Y:		Y:	
Group 6	R:		R:		R:		R:	
	Y:		Y:		Y:		Y:	
Group 7	R:		R:		R:		R:	
	Y:		Y:		Y:		Y:	
Group 8	R:		R:		R:		R:	
	Y:		Y:		Y:		Y:	

	Trial 1	Trial 2	Trial 3	Total <sup>14</sup>	
Bag A	R- <del>    </del> Y- <del>    </del>	R- <del>    </del>    Y- <del>   </del>	R- <del>    </del> Y- <del>    </del>	R-16 Y-14	① 10R 20Y
Bag B	R- <del>   </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R- <del> </del> Y- <del>    </del>	R-8 Y-22	② 15R 15Y
Bag C	R- <del> </del> Y- <del>    </del>	R- <del>  </del> Y- <del>    </del>	R- <del> </del> Y- <del>    </del>	R-4 Y-26	③ 25R 5Y
Bag D	R- <del>    </del> Y- <del>    </del>	R- <del>    </del>    Y- <del>   </del>	R- <del>    </del> Y- <del>    </del>	R-18 Y-12	④ 10R 20R
Bag E	R- <del>    </del>     Y-	R- <del>    </del>     Y- <del> </del>	R- <del>    </del>     Y- <del>  </del>	R-27 Y-3	⑤ 25Y 5R

I think that in bag A there is 15 red 15 yellow. The reason I think that is because when I finished pulling everything out of the there were 16 red 14 yellow. I also used process of elimination.

Kyle Borek

	Trial #1	Trial #2	Trial #3	Total	
3 Bag A	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R-16 Y-14	Possible Combanity 3
3 Bag B	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R-8 Y-22	10R 20Y 15R 15Y
3 Bag C	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R-4 Y-26	25R 5Y 20R 10Y 25Y 5R
3 Bag D	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R-18 Y-12	
3 Bag E	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R- <del>    </del> Y- <del>    </del>	R-27 Y-3	

My explanation:

After experamenting with 5 trials of bag C, I thought I had an idea of 2 possible combinations: 25Y and 5R and 15R and 15Y. Well really now I think I have come up with 1 possible combination 25Y 5R. I think this because, if you put

more on the R and take  
away 1 on the Y you have  
5R 25Y. Now I know  
Bag A has: 15R 15R  
Bag B has: 10R  
20Y

Bag C has: 5R 25Y  
Bag D has: 20R 10Y

Bag E has:  
25R 5Y

