

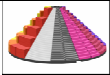


Activity F.2  
Sunken Treasures

**Game Objective:** A ship carrying a cargo of jars of 11 kinds of spices has been shipwrecked. A pirate has captured the ship and will only give the jars of spices back to spice merchants under certain conditions. Spice Merchants will only be profitable if they can capture at least 90% of their spices back.

**Recommended Number of Players:** 1 - 4 (standing) and 1 (or more) pirate. Only the pirates are allowed to read the rules! They set up the game in secret before the spice merchants arrive.

**Ages:** 11 & up



Setup by pirates only:

- 1) Put staircases in counterclockwise sequence  $1x \rightarrow 12x$ . For this game the  $2x$  staircase will be in play. Just rest the tokens on top of the steps on the  $2x$  staircase because there are not any notches on it.
- 2) For staircases  $2x \rightarrow 12x$ . Using any foam card that does not match the color of the staircase, select the tokens representing the multiples for the staircase and put them directly in the Treasure Trove. You can't let the spice merchants know which foam card was used to generate which multiples.
- 3) Mix up the tokens in the Treasure Trove – they now have become spice jars, and the staircases are spice chests with jar holders (notches) to represent maximum capacity for each chest.

**Play:**

- 1) Invite the spice merchants into the room and tell them the game objective (see above).
- 2) Tell them that as a pirate you are a little dastardly so you've imposed some rules:
  - a. Spice Merchants, you must place any jar (token) that you want to keep in a chest (notch on a staircase) immediately after consultation with your fellow merchants.
  - b. Any jar not placed in a chest immediately becomes your (as pirate) permanent property, and you will display it prominently for all to see (on the tabletop).

Hints: **But Don't Tell the Merchants!!**

<p>c. Any empty chest can hold any color of spice, but any chest can hold only one color of spices.</p> <p>d. Each chest has a different capacity of jar holders (notched steps only). Once they have exceeded the capacity of the chest, all subsequent jars of that color of spice are forfeited to the pirate.</p> <p>2) Begin play. On each turn (until there is at least one spice jar in each chest), each merchant draws a spice jar from the Treasure Trove, and together they develop a strategy of where to place the jars. Then all merchants put their spices in a unoccupied holder in the chest, <u>number side up</u>. After each chest has at least one spice jar in it, spice merchants no longer need to take turns – they should fill the chests as quickly as possible.</p> <p>3) Any time you see a chest with more than one color spice in it you get to capture all the jars in that chest. Leave the captured jars number side up on the tabletop.</p> <p>4) After all jars have been claimed (by either the spice merchants or you), spice merchants need to calculate whether they are profitable they must have recaptured at least 90% of the total.</p> <p>5) <b><u>Don't tell the merchants</u></b> specifically how to calculate the answer. Instead review what a percentage means. FYI there are 74 spice jars so they need to capture at least 67 spice jars (and you no more than 7) for them to remain profitable.</p>	<p>To place jars optimally, the merchants will need pay attention to clues provided by the numbers on the tokens but don't tell them – let them develop the reasoning and problem solving skills to figure it out. To begin with they don't pay any attention to the numbers (because we haven't told them to). The key to winning will be to use factoring skills, identify common multiples, and use complex reasoning for proper placement. You know there is a one-to-one match of spices to notches based on multiples. If they can figure out which color of tokens represents which multiple (and therefore which chest to put it in) they will win. Some sacrifices early allow for the best decisions. See the special note below for a more detailed discussion and some examples of reasoning required.</p>
<p>Special Note: Plan to allow spice merchants to play 3 or 4 quick games in a row. After each chest has a color in it, everybody (including you) works quickly to get the remaining spices in chests.</p> <p>1) First time they play, they will probably use no math skills, because the dastardly pirate that you are, didn't tell them to.</p>	

They will think the game is so easy, until about half way through when you start capturing a lot of spices. Unless they happened to guess right and put the multiples of 2 on the 2x staircase, they will only capture 50%-70% of the spices.

- 2) The second or third time they'll recognize which color has the most frequency and agree to put it on the 2x staircase, but their reasoning won't be based on numbers yet.
- 3) Over time they will begin to use numbers as a clue to guide them. They can observe both tokens in the chests and ones you've captured to begin to use sophisticated reasoning to optimize placement. When they actually use multiples, factoring, process of elimination, and mental "decision trees", they will win.
- 4) Examples of reasoning required:
  - If they draw a jar Color A numbered 25 they know all Color As can be put on the 5x staircase because 5 is the only factor (besides 1, and itself) of 25. Therefore the 5x staircase will have the maximum capacity needed for the Color A spices.
  - If they draw a Color B 30 early in the game they may be better off letting the pirate capture the spice and wait until they get other color clues to decide which multiples are represented by Color B (possibilities: multiples of 2, 3, 5, 6, or 10). A mistake can be costly; if they place Color B on the 10x staircase but it actually belongs on the 2x staircase, they would have to sacrifice 9 jars. They will only have room for 3 jars but they need room for 12.
  - If they draw a second Color B token numbered 36 they know Color B cannot be multiples of 5 or 10 because 36 is not a multiple of those numbers. So Color B must be a multiple of 2, 3 or 6 but they still may not have enough information based on these two pieces of information alone. Comparison to colors of other known numbers may guide their choices. For example if they can see the number 9 whether or not it is in the right place or even if it has been captured, and it is a different color, they can now rule out multiples of 3 for Color B.
  - Sometimes it might be best for spice merchants to purposefully place two colors in the same chest to let you, the pirate, capture all the jars on that staircase rather than continue down a path that requires too much sacrifice. When the chest is empty any color can be placed in it. However if you want to be true to character, you can wait to capture the jars in the chest until they have had to make many more sacrifices. This makes them place a higher value on reasoning from the start and makes them less willing to leave things to chance. It is fun being the pirate!
- 5) Next time you set up to play a series of games, try to use a different color for multiples of 2 and 3, so they can't rely on frequency in previous games to guide them and avoid reasoning in this one. It is not as important to vary colors of the other multiples.
- 6) Once players become proficient in this game, enlist them as pirates to lead other games.