Probability: Fire

Grade Levels

This activity is intended for Grades $6-8$.

Objectives and Topics

The purpose of this activity to learn about probability using a model for forest fire.

Activity	Suggested Time	Materials	Preparation
Introduction	10 minutes	Instructions	Read instructions & example page to learn the procedure. Understand the activity well enough to lead a motivating discussion.
Execution	30 minutes	Worksheet and Dice	See below
Discussion	10 minutes	Chalk, board, and/or document camera	See below
Wrap-Up	5 minutes		See below

Introduction

This activity will be to simulate a forest fire. Students will use a little strategy to try to "survive" the fire.

Walk through a sample simulation with a small (e.g. 4×4) grid (see the instructions and example page). Follow the procedure until the example simulation is complete. After this, explain the concept of a rock and do (part of) another small simulation with one or two rocks on the map.

Point out that in a given square, fire can spread to it from any of its neighbors that are on fire, so it may be "safe" at first and then catch on fire later.

Materials and Resources

Worksheets (see Sections "Forests Worksheet" and "Example Solution" below) and Dice are needed for this activity.

Execution

Put students in pairs. One will roll the dice and the other will record the results. Students can swap jobs between simulations (there are six on the provided worksheet). Although the students are in pairs and this activity is game-like, the two students are not competing with each other. They are just dividing up the work required to perform the simulation.

Depending on number of groups and time available, students may want to fill out the simulations randomly instead of doing each in order, so that not every group did the first three out of six if there is not time to do each one.

Discussion

After the activity is complete, lead a class discussion on the results. If a document camera is available, put different groups' results up for the class to see. Point any clever strategies or interesting results.

A couple of possible discussion points are:

1. What a good strategy for rock placement?
2. Is it better to start a fire in a corner, along a side, or in the middle?
3. If the "forest" was just a 5×1 grid, with the person on one end and the fire on the other, what is the probability that the person survives)? This is normally a high school-level question, but the calculation can be shown and the idea presented to younger students. How does this change with lower/higher spreading probabilities?

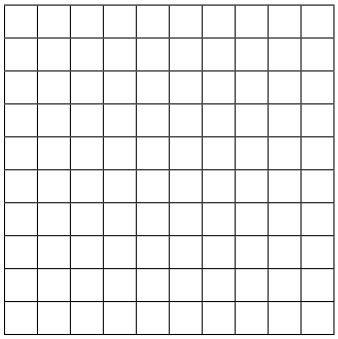
Have a wrap-up discussion. A journal topic can be assigned on this activity (in-class if time permits, or as homework).

Another resource is the following computer-based simulation that behaves similarly:

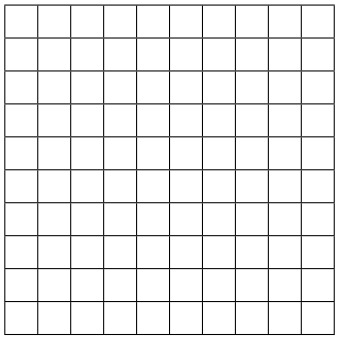
http://www.shodor.org/interactivate/activities/FireAssessment/

Forests Worksheet

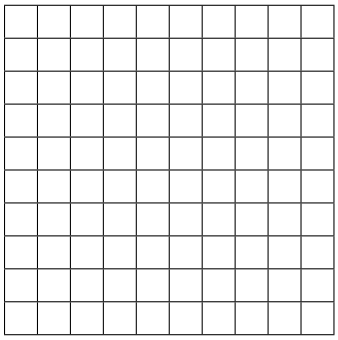
Forests Worksheet Instructions: Pick a square to stand in, and a square for the fire to start in. In each direction, roll a die to see if the fire spreads. Repeat the for each square the fire spreads to. If a space is filled in with a rock, it cannot catch on fire, but you can't stand there either.



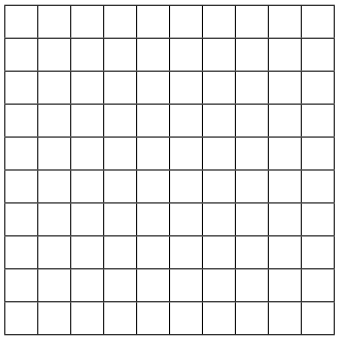
Fire spreads for: _____ (Pick 3)



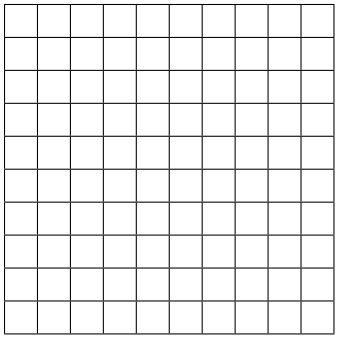
Fire spreads for: _____ (Pick 3)
Pick 5 Spaces to be Rocks.



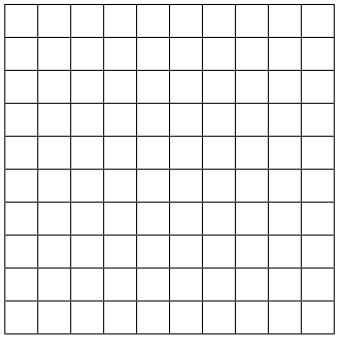
Fire spreads for: _____ (Pick 1)



Fire spreads for: _____ (Pick 1)
Pick 5 spaces to be Rocks



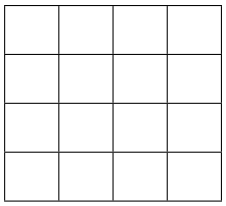
Fire spreads for: _____ (Pick 5)



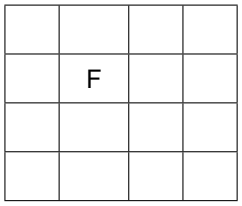
Fire spreads for: _____ (Pick 5)
Pick 5 spaces to be Rocks

Example Solution

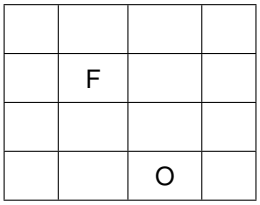
Example Solution



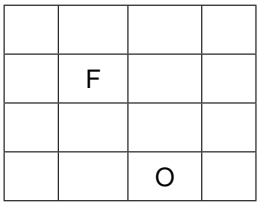
The grid represents a forest. Each empty space has a tree in it.



Pick one square for the first to start in, mark it with an 'F'

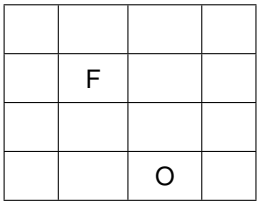


Pick one square for you to stand in, put a stick figure or a face there

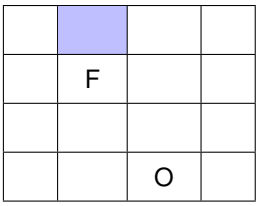


Pick some numbers for the first to spread. If it says "Pick 3" then pick three numbers from 1 to 6.
Fire spreads for: $\underline{1, 3, 5}$
(Pick 3)

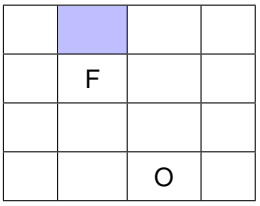
This means that when the die is rolled, if it's a $1, 3$, or 5, the fire spreads. If it's a $2, 4$, or 6, it doesn't. You can pick whichever "lucky numbers" you want.



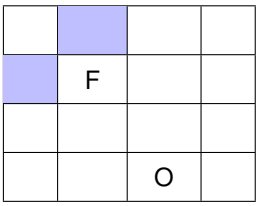
Now the fire can possibly spread in each direction: North, South, East, and West.



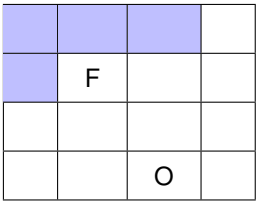
To check if it spreads to the North, we roll a die. It lands on 5, so it spreads! Shade in the square.



To check if it spreads to the East, we roll a die. It lands on 2, so it doesn't spread. To make a note of this, put a small "x" to the east of the square we just checked. The fire will not spread in this direction.

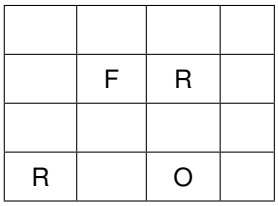


Continue doing this. Once you're done checking the first square, check the others that are now on fire.



The square to the right of "F" was safe when we checked if the fire spread from the left, but now the fire could spread from above it also. We need to check it in that direction also.

Continue doing this for each square that is on fire. You will see how far the fire spreads – hopefully it doesn't come to you!



In some of the simulations, there are rocks on the map. Rocks cannot catch on fire, but you cannot stand on top of a rock, or completely surround yourself with rocks.