***- Let’s Begin…***

*Write three clear sentences that introduce your lesson without giving too much away. This section is a great place to set expectations for the video and to outline the learning objectives for the lesson.  Here’s an example:*

Creating peace between two hostile groups sometimes requires separating them geographically. When this is impossible, some members of the groups may need to swap places. The question is how to do this in a minimal way.

 ***- 5 multiple choice questions that help gauge understanding (please highlight the correct answers):***

*Please attach all relevant timecodes for each multiple-choice question. If you’re completing the materials prior to the animatic stage of production, draft the questions based on the script, and follow-up with the respective timecodes. Here’s an example:*

A lovely spring started to change the moods of the soldiers. They became tired of war and began to feel spring fever. Some of them got the idea that instead of swapping camps fully, two camps would exchange half of their troops and now the camps became "neutral" meaning that each camp would allow both Greeks and Trojans to pass. So, now the goal is to ensure that any Trojan can go from a Trojan or neutral camp to any other Trojan or neutral camp passing only through Trojan or neutral camps. Similarly for the Greeks.

1. In that case, given the same initial setup, how many "neutralizations" between neighboring camps would be necessary? A camp can participate in only one neutralization.
2. 1
3. 2
4. 3
5. 4
6. 5

Ans: b

Explanation:

Figure A: Initial Positions

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| A | A | A | A | B | A | A | A | A | A |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |

Solution to Question 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| A | A | A | N | N | N | A | A | A | A |
| B | B | B | N | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |
| B | B | B | B | A | B | B | B | B | B |

2) Consider the setting below. How many swaps would be required so the As are all connected via horizontal and vertical moves and for Bs as well?

 a. 2

 b. 3

 c. 4

 d. 5

 e. 6

Ans: d. Please see below

|  |  |  |  |
| --- | --- | --- | --- |
| B | B | B | B |
| A | B | B | B |
| B | A | B | B |
| B | B | A | B |
| B | B | B | A |
| A | A | A | A |
| B | B | B | A |
| B | A | A | B |
| B | A | B | B |
| A | B | B | B |
| B | B | B | B |

Solution with Swaps

|  |  |  |  |
| --- | --- | --- | --- |
| B | B | B | B |
| b | a | B | B |
| B | A | B | B |
| B | a | b | B |
| B | a | B | A |
| b | A | A | A |
| B | B | a | b |
| B | A | A | B |
| B | A | B | B |
| b | a | B | B |
| B | B | B | B |

3) Given the same setup, how many would neutralizations would be required?

 a. 2

 b. 3

 c. 4

 d. 5

 e. 6

Ans: c. Explanation:

|  |  |  |  |
| --- | --- | --- | --- |
| B | B | B | B |
| n | n | B | B |
| B | A | B | B |
| B | B | A | B |
| B | B | n | A |
| A | A | n | A |
| B | B | B | A |
| B | A | n | n |
| B | A | B | B |
| n | n | B | B |
| B | B | B | B |

4. In the solution with swaps, if any A could force a swap with any neighboring B (vertically, horizonally or diagonally), could that A make any camp of Bs unable to travel to some other B passing only through camps?

a. yes

b. no

Ans: yes.

See the italicized a and b.

|  |  |  |  |
| --- | --- | --- | --- |
| B | B | B | B |
| b | a | B | B |
| B | A | B | B |
| B | a | b | B |
| B | a | *a* | A |
| b | A | *b* | A |
| B | B | a | b |
| B | A | A | B |
| B | A | B | B |
| b | a | B | B |
| B | B | B | B |

5. In the solution with neutralization, if any A could force a swap with any neighboring B (vertically, horizonally or diagonally), could that A make any camp of Bs unable to travel to some other B passing only through B or neutral camps?

a. yes

b. no

Ans: b. The only way this would be possible is if an A were surrounded by three As. But that is not the case.

 ***- 3 open-ended questions that allow learners to write complex thoughts about what they've learned:***

1. We see that neutralization is sometimes a much better solution than swapping in that it requires fewer soldiers to move. Achieving this is difficult when there is deep antagonism, but it can happen. Discuss the strategy of Rwanda.
2. Find cases in which population exchange among warring groups has led to peace after a difficult transitional period. Here are some examples to choose from: (i) India and Pakistan after the end of the British Colonial Period (ii) the breakup of Yugoslavia especially in Kosovo and find others.
3. Then find cases where it happened reasonably peacefully. (i) Northern Ireland and the Republic of Ireland

 ***- Dig Deeper…***

*The section is your chance to extend the learning.  You can include links to other videos; excerpts from books, articles, newspapers; your personal website (especially if it directs learners to a deeper understanding of the topic); websites of institutions and organizations that specialize in the discipline or topic of your video; etc.* ***Please make sure your Dig Deeper section is less than 5000 characters.***

**Please hyperlink resources to written excerpts to help the audience engage with the material. As a reference, here are three lessons that have excellently crafted Dig Deeper sections:**

The mathematics of this puzzle is related to the field of combinatorial geometry.

<https://mathworld.wolfram.com/CombinatorialGeometry.html#:~:text=Combinatorial%20geometry%20is%20a%20blending,discrete%20properties%20of%20these%20objects>.

Here is a group of fun puzzle-type mathematical puzzles:

<https://www.ics.uci.edu/~eppstein/junkyard/combinatorial.html>

 ***- Discussion Question…***

*This question should engage all learners in a public discussion about the lesson. We strongly suggest that after your lesson is published, you visit your Lesson page and engage in this question directly. Please keep this shorter than 150 characters. You can even share the discussion via a unique URL:*

The history of Western Europe after the fall of the Roman Empire is one of continuous wars. Sometimes the wars were local, between different nobles. These gave rise to central governments of various strength to put down internal civil strife. That in turn gave rise to the European Union which was supposed to end wars among members forever. How has that worked out?

 ***- Teacher notes. Why these questions?***

*These notes serve as reference for the TED-Ed staff. We’ll use them to modify any questions that exceed our website’s formatting capabilities or we’ll deliver them to educators that request further explanation. It’s also an opportunity for you to give reference to any information you haven’t properly cited in your script or lesson materials. You can write as detailed an explanation or as little information as possible. This section is entirely optional.*

The short questions are to ensure that the students understand the basic math. The longer questions are to explore some of the fundamental issues and the intersection with statistical methods.

***- Which grade level would your lesson cater to most appropriately? (Please check all that apply)***

elementary/primary, middle school/lower secondary, high school/upper secondary, or college/university

High school and up for students interested in political science.