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Proofs and Logic

Group Project

MAT 2071

A group project is looked at as an opportunity to work with your peers and share ideas. It is meant to help explore the multi-faceted ways one may think, along with the ideas of group members, through ways of brainstorming and attempting to think outside of your usual element. The Bridges and Walking Tours problem is a type of puzzle. The purpose of this problem is to use critical thinking and analyzing in order to find a solution. The puzzle can be very basic or very complex. It is comprised of areas that are connected by bridges, and the objective is to be able to have access to all areas while only crossing each bridge once. It is extremely simple to create and impossible puzzle, as well as a very easy and straightforward puzzle. For that reason, the ultimate goal of the puzzle is to create a tour, or map, that is extremely difficult to solve but has a solution. All things considered, the Bridges and Walking Tours problem is extremely interesting and engaging, whether trying to make a difficult puzzle or trying to solve one. This project has proven to be challenging beyond what was originally thought. Our group’s task started with making a puzzle that stemmed from attempting to solve the walking bridge tour, which we deemed as impossible to solve, we proceeded to play around creating our own puzzles and then attempted to make a few seemingly challenging puzzles as a group which our professor successfully solved.

Originally, one member of the group believed that the project was focused on one aspect of the bridges and walking tour, so her original conjecture was, “If you start in the middle of the island that has five bridges then you would be able to walk across each bridge without crossing either one twice.” After working on the puzzle over and over again, she came to the realization that her conjecture was false. She states, “My conjecture was wrong because no matter where I started my tour from the middle of the island I still needed to cross the a bridge that I previously crossed. Then, I tried other starting points and had no success. So, I came to the conclusion, based on my efforts, there is no solution to for the bridges and walking tour game.” However, the puzzles that were displayed below the main puzzle were those who had solutions and those who did not have one. These puzzles were the basis of our conjectures. We then came up with another conjecture that states, “Starting point must have more than one bridge connecting to it if the puzzle has a solution.” Later, after further observation, we came up with another conjecture declaring, “If there is a point that only has one bridge connecting to it, and if the puzzle has a solution, then that point must be the starting or end point.”

*Tyniqua’s input: I find that this project was challenging because of my misunderstanding of how broad the project actually was. I thought I was limited to the original puzzle that we started out with. Being that I studied the puzzle intensely I noticed that there were no solution to the puzzle and I could not help to think that it had a lot to deal with the puzzle being symmetrical, and one side of the puzzle had no solution and neither did the other. Now completely understanding the gist of the project I like the last conjecture that my group came up with about the starting and end points, which always proved to be true anytime I tried a puzzle of that sort. One may wonder, is there a definite way to solve a solvable puzzle that will always work. My response to this would be, yes but the solution would be specifically to a puzzle of a certain type, what I would call a special case. For instance, my group’s conjecture only works with a puzzle that has an extension from itself. Now, if there were a closed puzzle, meaning all ends connected to each other, there would have to be another method for solving the puzzle of that type. For my group’s presentation I would like for us to use the final conjecture we came up with and include other puzzles as counter examples to that will show that each type of puzzle is unique and there are those that are impossible to solve by using specific rules, such as not repeating paths (kind of remind me of sets and lists). On another note, I enjoyed trying to solve the walking bridge tour and was astonished by the time and effort I actually had to put into it to come up with no solution. The most challenging part was keeping up with all the different possible paths to take to finish the tour, and that is where I find that the fact that one half of the puzzle mirrors itself and if there is no solution for one side it is possible to be no solution for the other side. I continued to do the puzzle and record my steps and I ran into to dead ends that led me to the conclusion there is no solution to the puzzle. My group members had some insightful thoughts on our conjecture that we chose to work with as a group, it goes as follows:*

Ahmad’s thoughts: I myself was not able to take part in the first group activity involving our conjecture. What I did do however is try to solve the first puzzle given to us at the start of this group activity. After many attempts I could not solve the puzzle, and so I decided that it was impossible to solve…. However, after being caught up to the groups’ conjecture, both Sonam and me agreed that the previous conjecture was false. The previous conjecture had been, “Starting point must have more than one bridge connecting to it, if the puzzle has a solution.” The easiest and simplest way to disprove this conjecture is to make a tour that has four points and three bridges connecting them. In this example, the starting point will always have only one bridge connecting to it in every solution, and there can be no solution in which there is more than one bridge. Therefore, the conjecture is not true. However, the idea of this conjecture was used and refined in order to make a new and improved conjecture. After disproving the first conjecture, we started to think about for a new conjecture all together. However, by observing the drawing we used to disprove the original conjecture, we were able to come up with a new conjecture.

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1 2 3 4

From this puzzle, we noticed something interesting. You are able to solve the puzzle is more than one-way, however, the point that has only one bridge is crucial. This specific puzzle can be solved in only four ways. The first two solutions can be derived by starting at point 1, either proceeding in the order 1-2-5-4-3, or 1-2-3-4-5. The third solution can be derived by starting at point 3, proceeding in the order 3-4-5-2-1. The fourth and final solution can be derived by starting at point 5, proceeding in the order 5-4-3-2-1. These are the only four ways to solve this puzzle. After observing the possible solution methods, we realized that for every single solution, the point 1, was either the starting point or the ending point. From this observation we refined our conjecture. Our conjecture proves true for every possible puzzle of Bridges and Walking Tours, provided the conditional statements are met. Our conjecture is, “If there is a point that only has one bridge connecting to it, and if the puzzle has a solution, then that point must be the starting or ending point.” However, I believe that our conjecture is still incomplete in the way that it is stated. In our conjecture, we affirm that the point that has one bridge must be the starting or ending point, which is true.

However, what we failed to do is also negate the fact that there can be no solution except that the one bridge point is the starting or ending point. I believe for the conjecture to be complete, it must include in it a statement of affirmation and negation at the same time. For example, if I say that Professor Reitz is standing, I have affirmed that he is standing. However, I have not negated the fact that there may be others standing with him. Likewise, if I state that no one is standing, I have negated everyone entirely, including Professor Reitz. So the complete statement must be, no one is standing EXCEPT Professor Reitz. Therefore, I believe, our conjecture would be more complete if we add a statement of negation at the end, making it, “If there is a point that only has one bridge connecting to it, and if the puzzle has a solution, then that point must be the starting or ending point for every solution.” Perhaps when we first formed the refined conjecture, we assumed that this negation is implied in the conjecture. However, while I was reading over the conjecture I did not feel that the statement is implied and that the addition must be made. After consulting my group members, they both agreed that the addition added clarity to the conjecture, without taking anything away from the original idea.

The following are examples of puzzles that further prove our conjecture. We kindly ask Professor Reitz to try and find a solution to these puzzles that disproves our conjecture.



