

**Assignment 1: Online Problem Solving Assignment**

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CURR 676: The E in STEM: Meaningful Content for Engineering

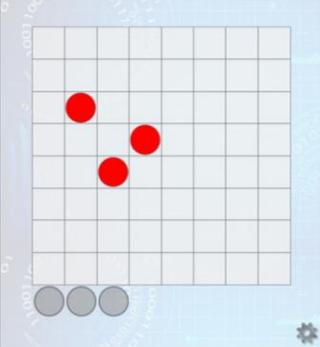
Professor Josh Brown

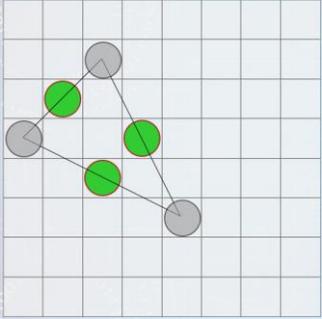
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For this assignment, I chose three different websites to use as a way to process problem-solving. These three websites are overviewed in Table 1.

**Table 1**

*Comparison of Problem-solving websites*

Name of problem	URL to access	Evidence of metacognition
The Three Jugs Problem	<a href="http://www.cut-the-knot.org/water.shtml">http://www.cut-the-knot.org/water.shtml</a>	<ul style="list-style-type: none"> <li>- Total is 8Q</li> <li>- 2 individuals</li> <li>- “Evenly” shared is 4Q/person</li> <li>- 3 jugs, two have graduations (3Q and 5Q) one presumably unmarked</li> <li>- 1<sup>st</sup> thought was that I could “eyeball” 1/3 of the 3Q one to get the 4Q, but then I noticed “exactly”, so that didn’t work</li> <li>- Drew out jugs</li> <li>- Recognized that 3Q can’t hold the final answer, but can be used to subtract partial volumes</li> <li>- Transferred a small portion each time and checked whether or not the requirements (2 4Q amounts) had been met</li> <li>- Answered after 6 transfers</li> </ul>
Entrapment	<a href="http://www.theproblemsite.com/games/entrapment.asp">http://www.theproblemsite.com/games/entrapment.asp</a>	 <ul style="list-style-type: none"> <li>- Moved pieces around and got confused as there weren’t enough gray dots to meet requirement of game</li> <li>- After dragging a piece, a diagonal “/” option showed up—I realized I had not considered that in my original assumption of the game</li> <li>- Then I went back and re-read the directions. I called my husband over to see what I had missed.</li> <li>- After looking at the example provided, I realized that with a 1:1 piece ratio, I couldn’t create a</li> </ul>

		<p>bunch of line segments</p> <ul style="list-style-type: none"> <li>- I then settled on a triangle as that's all I could make with the 3 dots.</li> <li>- I tried to match the orientation, and then I realized I needed to mirror it</li> </ul> 
<p>Wolf, Sheep, Cabbage</p>	<p><a href="http://www.plastelina.net/game1.html">http://www.plastelina.net/game1.html</a></p>	<ul style="list-style-type: none"> <li>- This problem reminded me of the first one I completed</li> <li>- I initially killed the sheep as I forgot the parameters</li> <li>- I had to keep remembering the relationships between the different items to move across the lake</li> <li>- As long as I “logic-checked” prior to each move, I was successful</li> </ul> 

In addition, the following questions were answered for the assignment requirements to be met.

**Which problems did you work through?**

I chose to work through The Three Jugs Problem, Entrapment, and Wolf, Sheep, Cabbage.

**Which problem was the easiest to solve?**

I personally found The Three Jugs Problem to be the easiest of the three to solve.

**Why was it easy to solve?**

I was able to physically manipulate this on pencil and paper more easily than the other two. In addition, since I do a lot of cooking and baking, I have changed proportions on recipes, so this task seemed familiar to me.

**What type of problem was it (see Kirkley, 2003 article pg. 8)? Explain.**

The type of problem was a well-structured problem. This is evident because there is only “one right answer” (both people need to have 4Q of liquid) and included all of the necessary starting information.

**What strategy did you use to solve the problem?**

The strategy I used to develop this strategy is “guess and check”, where I transferred a small portion each time and checked whether or not the requirements (2 4Q amounts) had been met as indicated in Table 1.

**How did you develop this strategy?**

I developed this strategy because it seemed the best way to make sure that I was moving along the correct path. If, for example, I kept adding only to one container, I would get farther from the goal of having both individuals receive the same amount of liquid.

**What declarative knowledge was needed to solve this problem?**

Declarative knowledge needed to solve this problem included various ways of adding up to 8. In addition, knowing that half of 8 is 4 was also necessary to know. Thirdly, knowing that liquids have a definite volume but indefinite shape (4Q is 4Q, but it can be poured and separated into different containers of different volumes) is beneficial.

**What procedural knowledge was needed to solve this problem?**

The procedural knowledge here was finding the new volumes each time through either adding or subtracting.

**Which problem was the most challenging for you to solve?**

The Entrapment puzzle was definitely the most challenging and the most frustrating to me.

**Why was it difficult to solve?**

This was not a surprise to me as I have a lot of issue with geometric orientations and manipulations similar to this. I have always struggled with getting lost and recognizing spatial relations of one object to another which was a key requirement of this puzzle.

**What type of problem was it (see Kirkley, 2003 article pg. 8)? Explain.**

For this problem, I identified it as a moderately structured problem. The Entrapment puzzle can be identified as a moderately structured problem because I believe that in the simpler stages, there is probably one solution, but I would think later on, there may be more than one. In addition, I felt that this problem required more “mental modeling, problem representation, analogical/abstract reasoning, and evaluation” (Kirkley, 2003, p. 8).

**What strategy did you use to solve the problem?**

Like the Three Jugs problem, I used an iterative strategy of moving a dot, checking to see if the requirements were met, and then placing another dot. In retrospect, this probably wasn't the best strategy as it led to assumptions on my part that were not correct.

**How did you develop this strategy?**

After recognizing some of the errors with my early strategy, I developed a new strategy that focused on not a 1:1 correlation of dots, but trying to visualize a way to “surround” the red

dots with the gray ones in a shape. My new strategy focused on also making connections between all of the dots.

**What declarative knowledge was needed to solve this problem?**

In order to solve this problem, I needed to know what a mid-point was. I also needed to know the “roles” of the red and the gray dots, and which of those dots could be manipulated and which were “locked” in place.

**What procedural knowledge was needed to solve this problem?**

Procedural knowledge for this problem included being able to calculate the midpoint and determining the symmetrical placement of a dot (however, in this particular interactive, a line did show up when a midpoint was correctly determined).

Through completing these problems, I was able to both demonstrate hands-on access to problem solving as well as evaluate it from the perspective of an educator.

## References

Bogomolny, A. (2000, May). The Three Jugs Problem. Retrieved from <https://www.cut-the-knot.org/ctk/Water.shtml>

Entrapment Game. (n.d.). Retrieved from <https://www.theproblemsite.com/games/entrapment>

Kirkley, Jamie. *Principles for Teaching Problem Solving*. PDF file. 2003.

Plastelina Logic games. (n.d.). Retrieved from <http://www.plastelina.net/game1.html>

