In addition to your agent, you should also write and submit a design report of roughly 1500 words. This design report should do a number of things. First, it should describe the reasoning your agent uses. How does it work? Second, it should describe how the agent comes to some of its correct answers. Third, it should describe why your agent makes some of the mistakes it does. Fourth, it should describe what could be done to improve the agent if you had more time, resources, or processing power. Fifth, it should describe the efficiency of the agent: how long does it take to run? What kinds of problems will force it to take longer? Sixth, it should describe the relationship between your agent and human cognition. What does your agent tell you about how people might solve these problems? Your design report can include diagrams in addition to the ~1500 words.

The agent for Project 2 works largely in the same way as the agent for Project 1. It reads each of the figures, corresponds the objects, proposes the attributes of what the solution should be, and chooses a best fit. However, it incorporates some expanded logic to better handle the new relationships between figures A, B, and C.

In Project 1, the agent only handled relationships between figures A and B, then applied those relationships to C. The first thing I tried in Project 2 was to test how many problems were correct using just the agent from Project 1 – only 6. I realized that the agent needed to take into account more than one relationship, so now, the agent finds the relationship between A and B, as well as the relationship between A and C, and asses the changes between either relationship to come up with the proposed solution D. Many problems benefitted from the implementation of multiple relationships, such as problem 14. If only the A-B relationship was taken into account, the agent would surely have chosen answer 1 (only taking into account attributes of figure B), when the correct answer is 2 (taking into account the black square).

It continues to use the same scoring mechanism for determining the solution that fits best to the proposed solution, with some slight changes to the weights. This increased the number of correct answers in the 2x1 problems by 2, which was a positive. I propose that there should not be different weights assigned to the relationships for the different problem sizes because the relationships still carry the same amount of meaning despite having more of them.

Furthermore, the correspondence problem has been fixed from the agent in Project 1. In Project 1, the agent had a correspondence solving method for objects, but it wasn't working correctly and would correspond the first object of one figure to the first object of the next figure, and so on. This has been fixed for Project 2. However, there is still an issue with correspondence as the agent is having trouble taking the correspondeded objects and correctly comparing the attributes. It will need to be fixed for future projects. This is especially troubling for problems like number 14, which has many objects and the ordering of them is not handled correctly. However, with only one object, the agent doesn't have any trouble. The agent can properly correspond the objects between A and B, A and C, and B and C, but handles the attribute ordering incorrectly. If there were more time, resources, or processing power, the corresponding objects issue would need to be fixed.

The agent should also better handle problems where an exact solution is not found to the proposed solution. Given more time, resources, and processing power, the agent could be improved with a "retry" method that would allow the agent to retry the problem using a different set of correspondences. Currently, the agent just looks at the “best fit” solution and chooses it without retrying. This is a big positive for the agent’s speed, but a negative for its ability to get correct answers. I believe the best example of this would be problem 17. The agent reads the best fit for the first set of correspondence and returns 5, which is the best solution based on the number of matching attributes, but the correct answer is 3, based on a different set of correspondences.

Another issue with correspondences is that I had a difficult time figuring out how to take care of deleted and added objects. For example, in problem 11, I can visually see that in the A-B relation, a filled square was added, and the A-C relation had a large circle added. I wasn’t able to figure out how to have the agent put the two additions together – instead, it can only see one of those shapes at a time. Given more time and resources, I believe there is an answer to this problem that I just wasn’t able to figure out.

As far as the efficiency of the program, it is still very fast. There is not a lot of complex logic involving retrying or trying all combinations of correspondences, so the agent doesn’t have to visit any problem more than once. The only kinds of problems at the moment which would make the agent take longer is if there is a large number of objects in the figures, which still wouldn’t take too much longer compared to the amount of time a more complex agent would take.

For the relation to human cognition, the agent tries to take into account logic that a human would use. For example, it attempts to take the changes between both the relationships of figure A and C and figure A and B, and combine them to form one proposed solution. A good example would be problem 16. From figure A to figure B, the triangle rotates. From figure A and figure C, the triangle is tripled. So the proposed solution would be three triangles that are rotated the same amount as in figure B. It also uses a “best fit” solution where it takes a guess at the solution that has the most attributes that match the proposed solution when it doesn’t find a perfect solution. Actually, here, it may digress a little from the human cognition – it doesn’t actually find a “perfect” solution, but the “best” solution. Of course, the human test always asks for a “best” solution and not the “perfect” solution, so perhaps it is doing what the test – and the people taking it – intend. One thing that the agent does similar to humans is that when it finds solutions that seem to be equally the best, it takes a guess at the answer.

Something that I found really difficult to figure out and thus had a hard time mirroring human cognition was angles. Humans can look at an object and see if it’s turned left or right, or perhaps reflected with “fuzzy facts.” A human doesn’t need to know the specific values of the angles to be able to compare rotations to one another and find them similar or different. On the other hand, the agent has to handle specific shapes and angles and therefore need many more rules to handle the different situations. Currently, the agent successfully handles some situations but not others – problem 1 (humans would see the pacman turning to the left) is being answered correctly, but problem 20 (humans would see the triangles turning to the right) is being answered incorrectly. The agent will need to be developed to handle rotations and reflections better by improving the calculations or adding more rules depending on the rotation value and shape. This, however, sets it even further apart from human cognition. Instead of thinking like a human by looking generally at the image then comparing it as a whole to other images, it dissects the image’s attributes and attempts to test against a list of rules to find the exact answer.

Overall, I found Project 2’s logic to be much more complicated than Project 1. The agent didn’t run into many correspondence problems in Project 1, but seemed to have quite some trouble with it in Project 2. It also had a lot more trouble reading attributes, especially angles, because it has to take into account multiple relationships instead of just the A-B relationship before finding a proposed solution. The agent will need to be improved in the future especially to be better at handling angles, but also using a retry method for attempting to find the solution for other correspondences than just the first found.