ISYE 3133 Fall 2021
Project Parts 3 & 4

1 Part 3

Now that we've covered integer programming, we can expand our model to help with choices we couldn't model with only linear programming.

The reserve has the resources to take in some animals that other reserves don't have space for. Up to 5 adults of each species are available for adoption, with some special requirements.

Firstly, while the reserve is willing to adopt any animals that need a home, it's important that the reserve continue to provide good care for the animals already residing there; so the objective will still be to maximize the average welfare score. (It is tricky to do this while keeping the objective linear–be very careful. You may need to maximize an equivalent function instead.)

The reserve would like to adopt at least 5 new animals, in order to help other reserves. There are some restrictions on what animals the reserve is able to house:

- The reserve has finished constructing a new big cat enclosure, and can move any of its big cat species from their current enclosure to the new one, which has much more space. Only one species can be moved to the new enclosure, so new animals of only one of the reserve's big cat species (West African Lion, Clouded Leopard, Cheetah, and Siberian Tiger) can be adopted.
- Whichever big cat species is adopted will move out of their current enclosure, which the reserve plans to retrofit to suit a new species. One new species (a species not currently in the reserve) can be adopted into this enclosure.
- There are also funds reserved for the renovation of up to two existing enclosures. (These do not count towards the reserve's operating costs.) Any existing enclosure that is not being retrofitted can be renovated; and a renovated enclosure can hold up to two more animals of the species currently living in it.

Modify your LP model (adding integer variables wherever necessary) to include the new information. As in Part 1, submit all of the following:

- A list of your parameters' names and definitions, with units where appropriate, labeled "Data"
- A list of your variables' names and definitions, with units where appropriate, labeled "Variables"
- Your MIP model.

2 Part 4

I recommend that you start Part 4 as soon as your Part 3 model is complete. Your implementation can serve as a way to check the correctness of your model; and changing your implementation after changing your model is not as difficult as implementing your model itself.

As in Part 2, use gurobi python to implement and solve your Part 3 model. If your Part 3 model was incorrect, you may resubmit a modified model to earn up to half of the lost points back. Your code should read in the data from the excel sheet; it should NOT be hardcoded. You may still modify the spreadsheet given; if you do, submit the modified spreadsheet(s) with your submission to this part of the project.

Comment your python code so that someone not fluent in programming could understand what each section of your code is intended to do.

Also submit a short write-up of your results that contains an explanation of your assumptions and your solution. It should include your solution in an easy-to-read-way (for example, copy-pasting output from gurobi directly into a Word file is not easy to read)–it should be easy for someone who is not familiar with coding, your model, or optimization as a whole to understand the solution. Your explanation of your assumptions should be concise; include any important assumptions made (either deliberately, or as a result of modeling the situation in the way described), focusing mostly on assumptions that someone might accidentally break with their decisions in managing the reserve.