

School Nova Computer Science 202

Homework 4 (due 10/24/2020)

Save your code as lastname_homework4.py and submit on Google Classroom

Revisit the problem that we discussed during the class work (a number of planes are departing and all but one arriving; each plane has a unique id; identify the missing plane).

Task 1

First, let's fix a possible problem of `random.randint()` generating the same id for different planes (technically, this is known as making a random draw with replacement). Instead, we need to use `random.sample()` to generate random values **without** replacement (this way, we will not draw the same value again). Your task is to figure out how to use `random.sample()` to generate a list of departing and arriving planes' ids (similar to what we did in class).

Task 2

Add an alternative function that uses a dictionary to find the missing plane. Compare which is faster: the list-based function (from classwork) or the dictionary-based function. Test on 20,000 planes. Can you explain the huge difference in speed?

Task 3

Imagine that instead of a list of IDs of the departing and arriving planes, you have objects from a class `plane` (with unique ID being one of the instance attributes). Can you implement this problem (and a solution) using an object-oriented programming approach? How would this approach compare to the previous model and solutions?

Task 4** (optional challenge, extra difficulty)

Can you implement an alternative solution to the planes problem using Numpy? Once again you have to start with a list that you generated in Task 1. However, this time you need to use a combination of numpy methods such as `np.unique()` (hint: use `return_counts = True`) and `np.where()`. Will the highly optimized numpy routines give you a faster solution to the problem?