2.1. For each one of the 30 available pairs of fingerprint images (15 from *genuine.txt* and 15 from *impostor.txt*), provide the minutiae-based similarity score, as defined in slide 41 of the presentation available at https://bit.ly/3PD35EZ. To present these scores, generate a single *output.csv* file with 30 data lines; the first 15 data lines must be respective to the 15 lines of *genuine.txt*, while the following 15 data lines must be respective to *impostor.txt*. Lines with comments must start with "#". The format of this file is explained in Figure 3 through an example, and it follows the same format of the input files used in the first assignment. (4 points)

```
# System output. Line format: label [0: impostor, 1: genuine],
score
1,0.6285714285714286
1,0.6046511627906976
(...)
0,0.1326530612244898
0,0.2732919254658385
(...)
```

Figure 3. Expected content for *output.csv*. The scores and number of lines presented here are for the sake of illustration.

|	
1,0.8909090909090909	0,0.13793103448275862
1,0.6074074074074074	0,0.18867924528301888
1,0.8703703703703703	0,0.15503875968992248
1,0.6751592356687898	0,0.22388059701492538
1,0.4756756756756757	0,0.2077922077922078
1,0.49101796407185627	0,0.23776223776223776
1,0.7333333333333333	0,0.22
1,0.6114649681528662	0,0.2011173184357542
1,0.782608695652174	0,0.25316455696202533
1,0.8089887640449438	0,0.1875
1,0.735632183908046	0,0.25263157894736843
1,0.8387096774193549	0,0.13861386138613863
1,0.5925925925925926	0,0.1610738255033557
1,0.46153846153846156	0,0.15625

1,0.5303867403314917	0,0.1782178217821782

2.2. Based on the scores you have obtained, what score threshold (a.k.a. operating point) should you use for this system? Please explain your answer and describe how you have obtained this threshold. (1.5 points)

The threshold should be 0.4615. I found this score by using the `compute_sim_fmr_fnrm_eer` function to calculate the equal error rate, which is when the false match rate and false non-match rate are closest to (or ideally, equal to) each other. By using this to calculate the threshold, we avoid showing a preference for false matches or false non-matches; rather, we find the threshold where both are low at the same time.

2.3. Plot and provide a graph with the distribution of the scores obtained by the system. What is the system's d-prime value? (1.5 points)

The system's d-prime value is approximately 4.72.
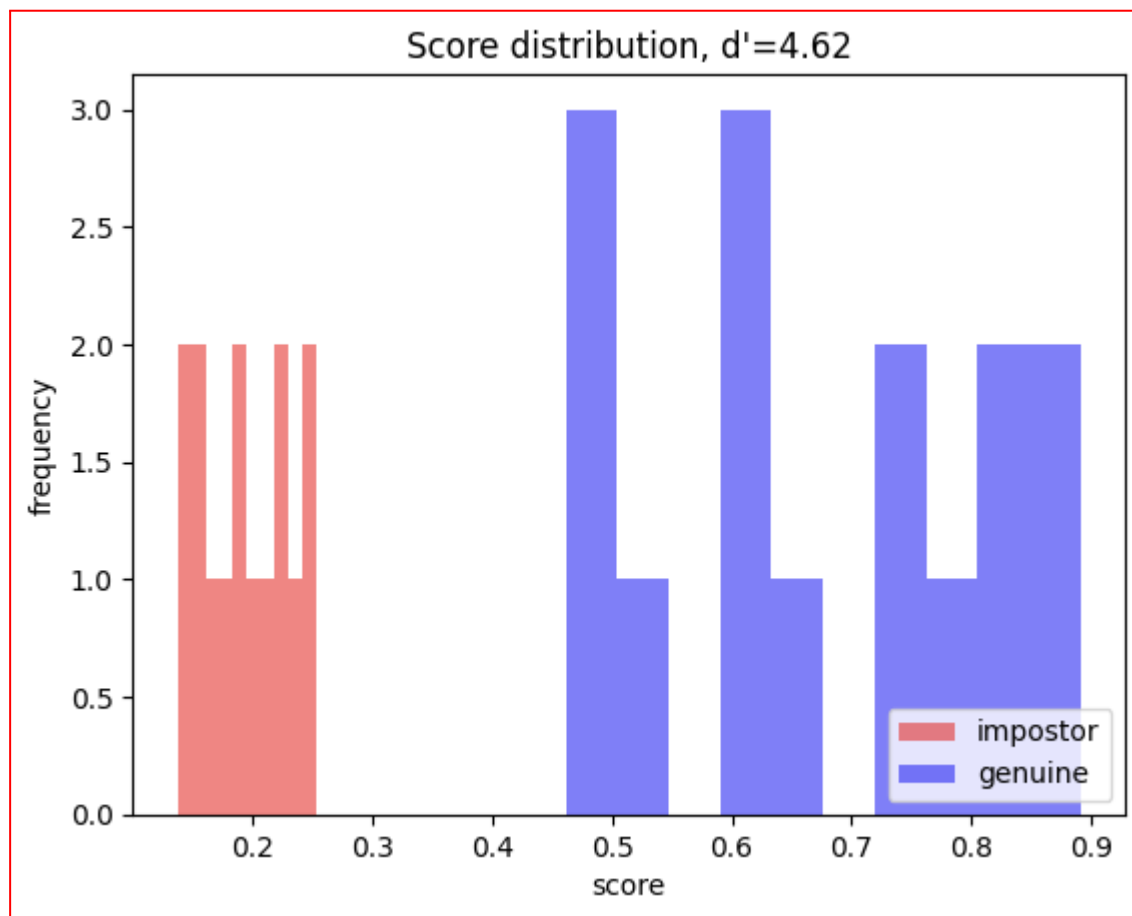
2.4. Plot and provide a graph with the ROC curve and AUC of the system. Is this system working better than chance? Please explain your answer. (1.5 points)
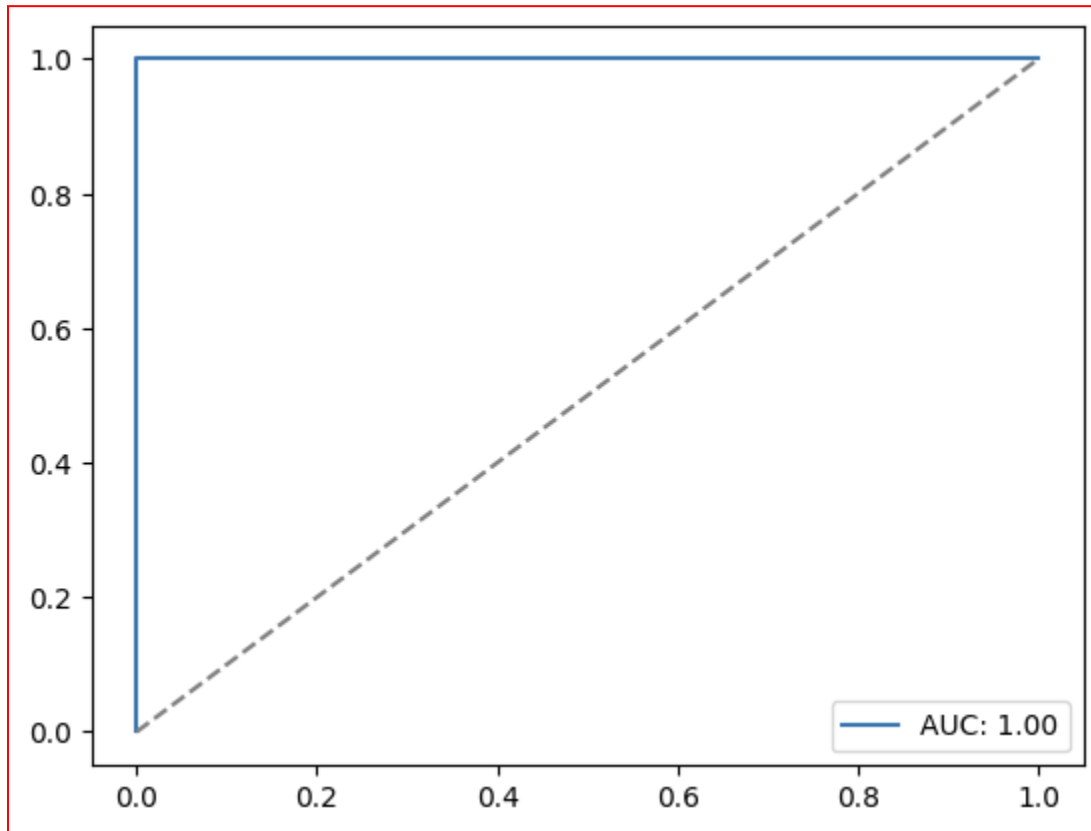
This system is working significantly better than pure chance. The chance diagonal is the dotted gray line- a curve with less area than the line would be performing worse than chance, where a system has a true 50/50 shot of making an error in either direction.

2.5. In your opinion, would this solution be robust to fake fingerprints such as silicon fingers? Please justify your answer. (1.5 points)

I would say this model is likely not robust enough to detect fake fingerprints such as silicone fingers. The reason is because our system only analyzes the level 2 features of the fingerprint, which are the ridge endings or the ridge bifurcations. Silicone fingers can reasonably replicate these features, but notably would not contain some of the deeper details such as level 3 features. In order to combat against silicone fingers, the model would require a sensor that has a high enough resolution to capture level 3 features, as well as having code that can also identify those features.