CS 412  
HW #2

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**Question 1**

**Work / Explanation**

1. We divide up the data into multiple bins with 3 in each (depth = 3). Usually we should order these values, however, the array is already in order, thus we just split it up into separate arrays.

**Data Set 1**

Data Set 1: [13 15 16 16 19 20 20 21 22 22 25 25 25 25 30 33 33 35 35 35 35 36 40 45 46 52 70]

Bin 1: [13 15 16]

Bin 2: [16 19 20]

Bin 3: [20 21 22]

Bin 4: [22 25 25]

Bin 5: [25 25 30]

Bin 6: [33 33 35]

Bin 7: [35 35 35]

Bin 8: [36 40 45]

Bin 9: [46 52 70]

**Data Set 2**

Data Set 2: [ 5 10 11 13 15 35 50 55 72 92 204 215]

Bin 1: [ 5 10 11]

Bin 2: [13 15 35]

Bin 3: [50 55 72]

Bin 4: [ 92 204 215]

Then we will find the mean of each bin.

**Mean of each bin for data set 1**

Bin 1: 14.666666666666666

Bin 2: 18.333333333333332

Bin 3: 21.0

Bin 4: 24.0

Bin 5: 26.666666666666668

Bin 6: 33.666666666666664

Bin 7: 35.0

Bin 8: 40.333333333333336

Bin 9: 56.0

**Mean of each bin for data set 2**

Bin 1: 8.666666666666666

Bin 2: 21.0

Bin 3: 59.0

Bin 4: 170.33333333333334

We will replace all the values in the bin with its mean to achieve the following

**Data Set 1**

Bin 1: [14.67 14.67 14.67]

Bin 2: [18.33 18.33 18.33]

Bin 3: [21. 21. 21.]

Bin 4: [24. 24. 24.]

Bin 5: [26.67 26.67 26.67]

Bin 6: [33.67 33.67 33.67]

Bin 7: [35. 35. 35.]

Bin 8: [40.33 40.33 40.33]

Bin 9: [56. 56. 56.]

**Data Set 2**

Bin 1: [8.67 8.67 8.67]

Bin 2: [21. 21. 21.]

Bin 3: [59. 59. 59.]

Bin 4: [170.33 170.33 170.33]

We join the bins back together then take variance

**Variances**

Variance Original Data 1: 161.29492

Variance Original Data 2: 4880.6875

Variance New Data 1: 146.71692

Variance New Data 2: 4059.8066

We now find the means

**Means**

DS1 Mean OG: 29.962962962962962

DS2 Mean OG: 64.75

DS1 Mean New: 29.963333333333335

DS2 Mean New: 64.75000000000001

Now looking at the means of each data set and comparing it with after smoothing by means to smooth, we see that we had the same means after we put all the data back together. The variance is different. Having variance is the average of the squared differences of the mean, it makes sense.

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Description automatically generated

Since the variance measures how far our set of number are spread out from their average value, it makes sense how our values changed unlike the means.

**Code (see file attached)**

**Output (see image attached)**