(1) Using Bayes' theorem and big libraries have more customers so that $P(lib\ N) = \frac{\text{Books in } N}{\text{Total books}}$

$$P(lib\ A \mid stat\ book) = \frac{P(stat \mid A) \cdot P(A)}{P(stat)}$$

$$= \frac{50/1000 \cdot 1000/(1000+800+1200)}{(50+15+20)/(1000+800+1200)}$$

$$\approx \underline{\underline{0{,}588}}$$

$$P(lib\ B \mid stat) = \frac{P(stat \mid B) \cdot P(B)}{P(stat)}$$

$$= \frac{15/800 \cdot 800/(1000+800+1200)}{(50+15+20)/(1000+800+1200)}$$

$$\approx \underline{\underline{0{,}176}}$$

$$P(lib\ C \mid stat) = \frac{P(stat \mid C)\ P(C)}{P(stat)}$$

$$= \frac{20/1200 \cdot 1200/(1000+800+1200)}{(50+15+20)/(1000+800+1200)}$$

$$\approx \underline{\underline{0{,}235}}$$

2&3) Outputs:

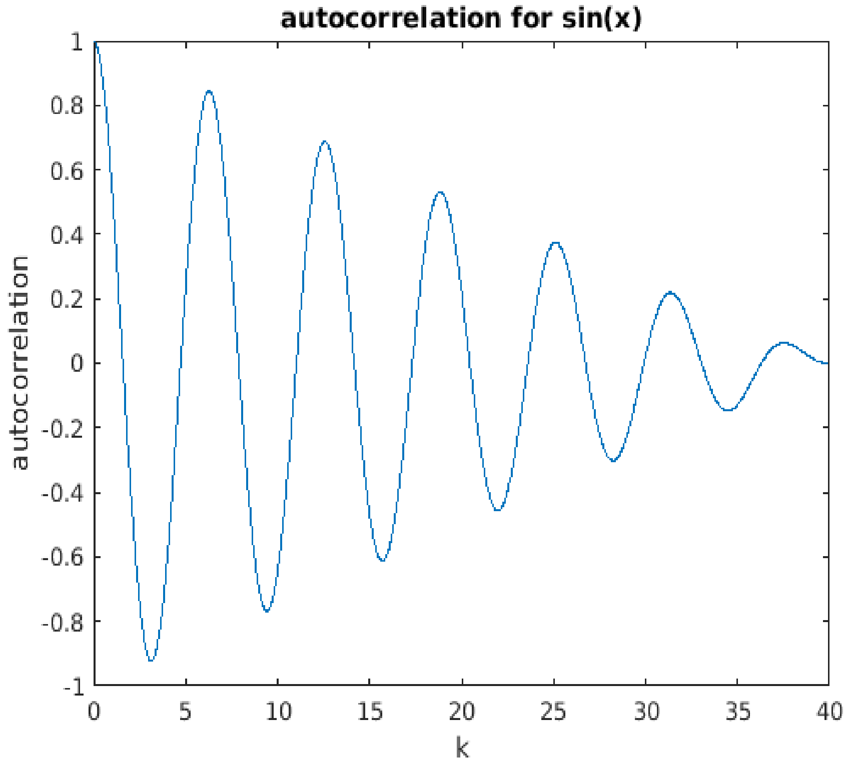
```
2i)  1.000000
2ii-1) 0.027365
2ii-2) 0.047452
3i)  1.000000
3ii-1) 0.026263
3ii-2) 0.038384
```

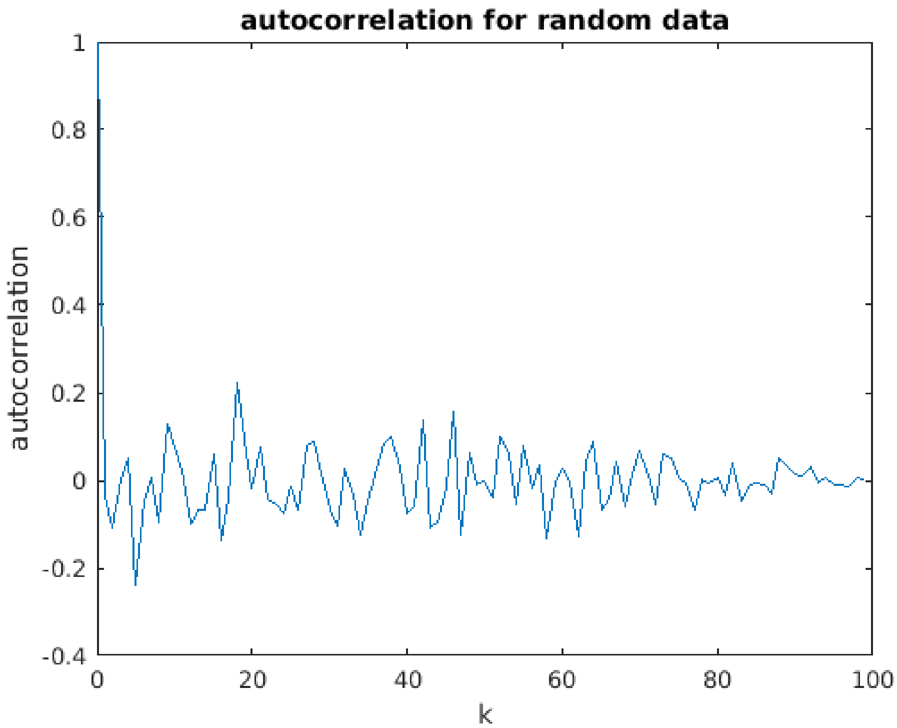
Correlation coefficient and Kendall’s tau for linear data is 1.0 as expected and both random data arrays (ii-1 and ii-2) have a coefficient very close to zero for both Pearson and Kendall bas expected.

4) I created an array with 2000 values of sin(x) with x ranging from 0 to 40. Autocorrelations plotted against values of k where k is not the index i but i*0.02 so that it corresponds to actual x-coordinate along the sin(x) curve. Here we see that there’s of course a spike where offset is 0 and another where k=2*pi which corresponds to the period of sin(x). In between these there’s a negative spike where offset sine corresponds to changing it to cosine. Amplitude getting smaller for bigger values of k is due to the numerator getting smaller when k gets bigger while denominator is unchanged. This can easily be seen from the definition of sample lag-h autocorrelation function as given in https://se.mathworks.com/help/econ/autocorrelation-and-partial-autocorrelation.html.

For random data I used data points created earlier. For them, correlation at k=0 was also 1, but after that the correlation jumps randomly around 0 as can be expected for random data.

See plots on next page.


autocorrelation for sin(x)
autocorrelation
k
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
5
10
15
20
25
30
35
40


autocorrelation for random data
autocorrelation
k
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
0
20
40
60
80
100