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50.005 CSE – Programming Assignment 1

3.1 Part 1: Getting Started [5 marks]

1. Let count(S, m, V) be the amount of coin combination that makes up a value of V, with m different coins and choices of coins with denominations of S[1], S[2],.., to S[m].

$$\text{count}(S, m, V) = \begin{cases} 0 & \text{if } (V < 0) \text{ OR } (V > 0 \text{ AND } m \leq 0) \\ 1 & \text{if } V = 0 \\ \text{count}(S, m, V - S[m]) + \text{count}(S, m-1, V) & \text{otherwise} \end{cases}$$

2. m(V+1)

3. 2

4. 2

5.

S\V	V=0	V=1	V=2	V=3	V=4
S=1	1	1	1	1	1
S=2	1	1	2	2	3
S=3	1	1	2	3	4

The answer is 4.

3.2 Part 2 - 5

See ProcTreeDPCoinChangeProblem.c

3.6 Part 6: Concluding everything [10 marks]

1. The average timings for each method are as follows: (in microseconds)

Sequential — [2236.000000, 1000.000000, 3089.000000, 842.000000, 1618.000000, 1661.000000, 815.000000, 1012.000000, 1560.000000, 1227.000000, 1162.000000, 974.000000, 1098.000000, 2336.000000, 1707.000000, 1235.000000, 1346.000000]

Threads — [1131.000000, 943.000000, 1281.000000, 1656.000000, 2336.000000, 1762.000000, 2077.000000, 2677.000000, 3975.000000, 4119.000000, 3087.000000, 3724.000000, 2709.000000, 4056.000000, 4792.000000, 4462.000000, 4103.000000]

Processes — [1365.000000, 1462.000000, 1033.000000, 1455.000000, 1203.000000, 1834.000000, 2269.000000, 549.000000, 543.000000, 910.000000, 778.000000, 1509.000000, 2090.000000, 2125.000000, 1289.000000, 2685.000000, 3055.000000]

2. The average timings for each method are as follows: (in microseconds)

Sequential — [3104.000000, 3479.000000, 3311.000000, 905.000000, 1229.000000]
Threads — [3383.000000, 15027.000000, 4784.000000, 5385.000000, 6076.000000]
Processes — [5767.000000, 6337.000000, 6648.000000, 14350.000000, 10151.000000]

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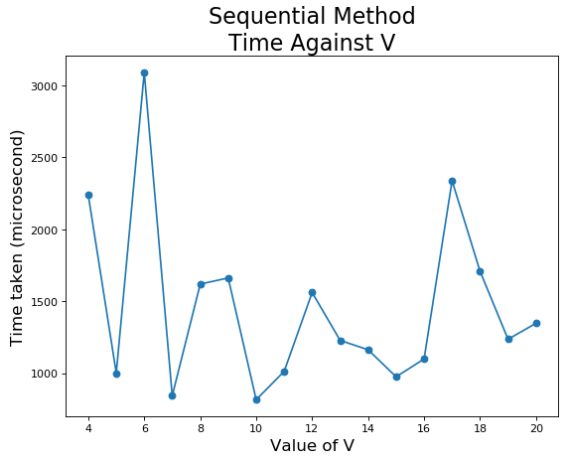
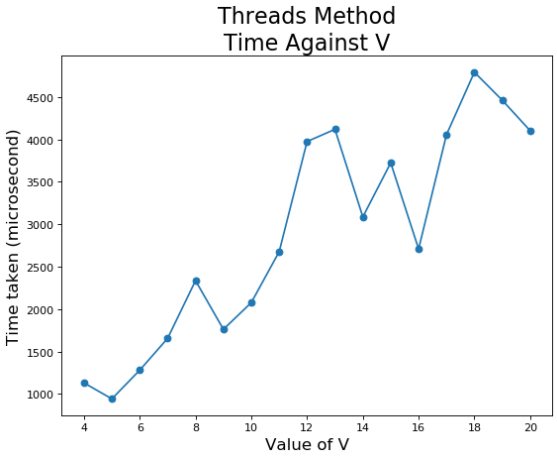
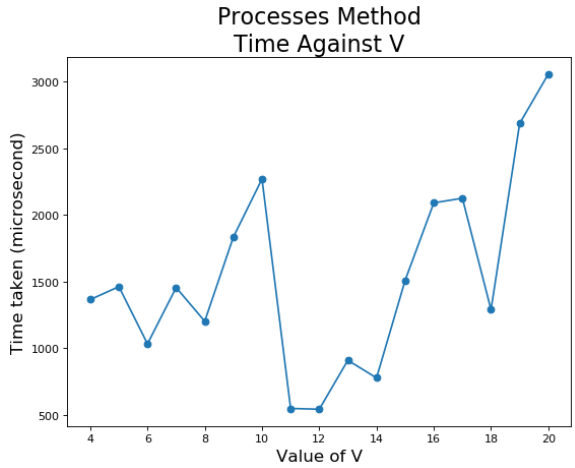
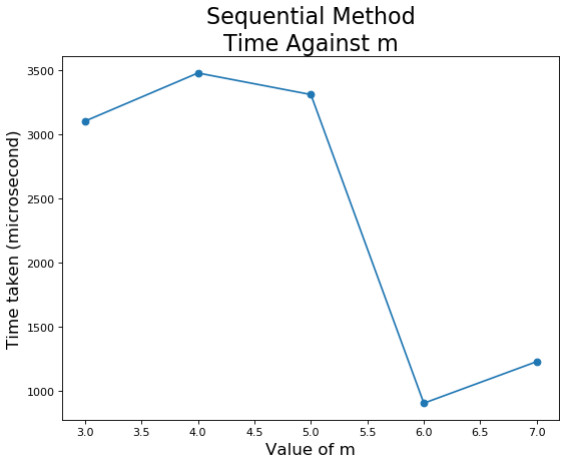
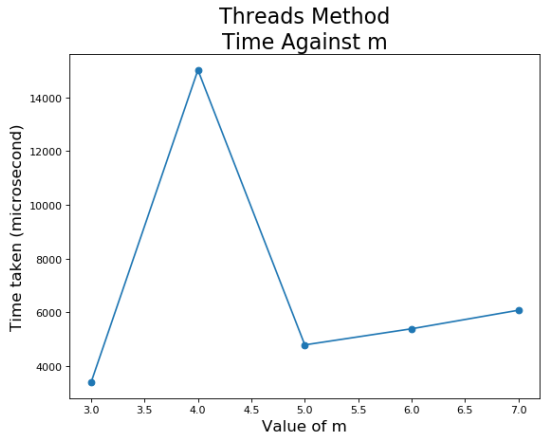
3.

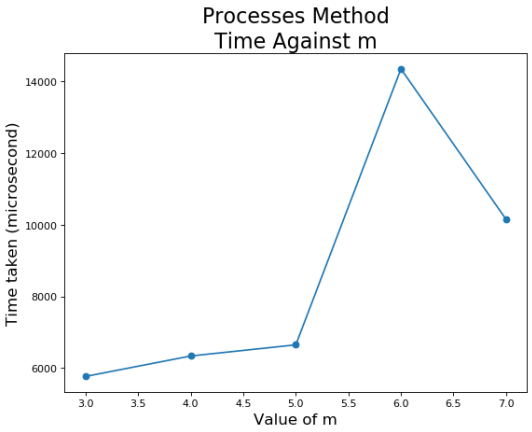












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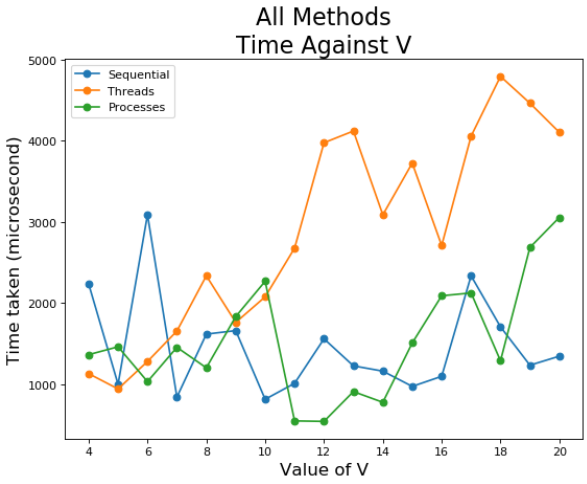
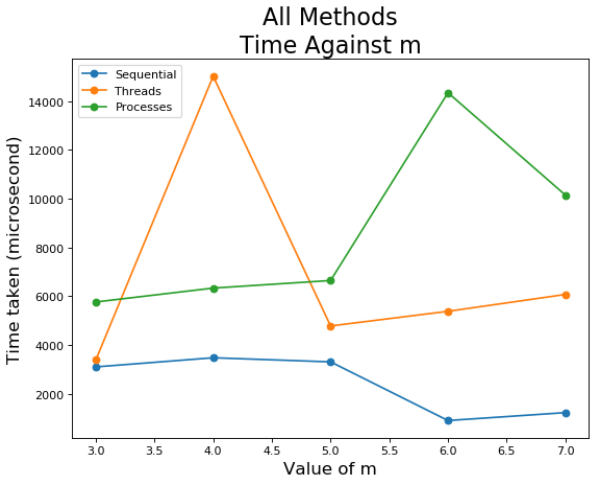
4.





From the combined graphs above, we can see that the sequential method generally takes the least amount of time. This is especially so when m > 5 or when V > 19 (from graphs above).