

# EE382V Multicore Computing: Assignment 1

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## Question 0

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## Question 1

Part (a)

- Assuming other parts of the program can be sped up by the factor of  $n$ , then the overall speedup is

$$Speedup = \frac{1}{0.4 + \frac{0.6}{n}}$$

- Assuming the method M accounts for  $x$  of the program's execution time on a single-core processor, M can be sped up by  $2^3$  and other parts of the program can be sped up by the factor of  $n$ , then the overall speedup is

$$Speedup = \frac{1}{\frac{x}{8} + \frac{(1-x)}{n}}$$

So in order to double the speedup, we require

$$\frac{1}{\frac{x}{8} + \frac{(1-x)}{n}} = 2 \times \frac{1}{0.4 + \frac{0.6}{n}}$$

which leads to

$$x = \frac{0.2n - 0.7}{0.125n - 1}$$

Therefore, M must account for  $(0.2n - 0.7)/(0.125n - 1)$  of the total execution time **on a single-core processor** in order to double the overall speedup of the program.

## Part (b)

Assuming the parts of the program that can be totally parallelized account for  $P$  of the total execution time on a single-core processor, and all of the other parts of the program, which accounts for  $(1 - P)$  of the total execution time on a single-core processor, are not able to gain any speedup from the multicore architecture, then we have

$$S_2 = \frac{1}{(1 - P) + \frac{P}{2}}$$

and

$$S_n = \frac{1}{(1 - P) + \frac{P}{n}}$$

Solving the equations, we get

$$S_n = \frac{nS_2}{(2 - n)S_2 + 2(n - 1)}$$

## Question 2

## Question 3

In order make Filter Algorithm able to solve the l-exclusion problem, we can simply reduce the number gates from  $N$  to  $(N - l)$ .

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```
const int  N;
int[N]     gate init 0;
int[N-1+1] last init 0;

/* For P_i */
request CS;
for (k = 1 : N - 1) {
    gate[i] = k;           // P_i is at gate k
    last[k] = i;           // P_i updates last for that gate

    for (j = 1 : N - 1) {
        while (j != i && gate[j] >= k && last[k] == i)
            NO_OP();
    }
}
CS;
release CS;
gate[i] = 0;
```

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## Question 4

\* Code submitted on Canvas.

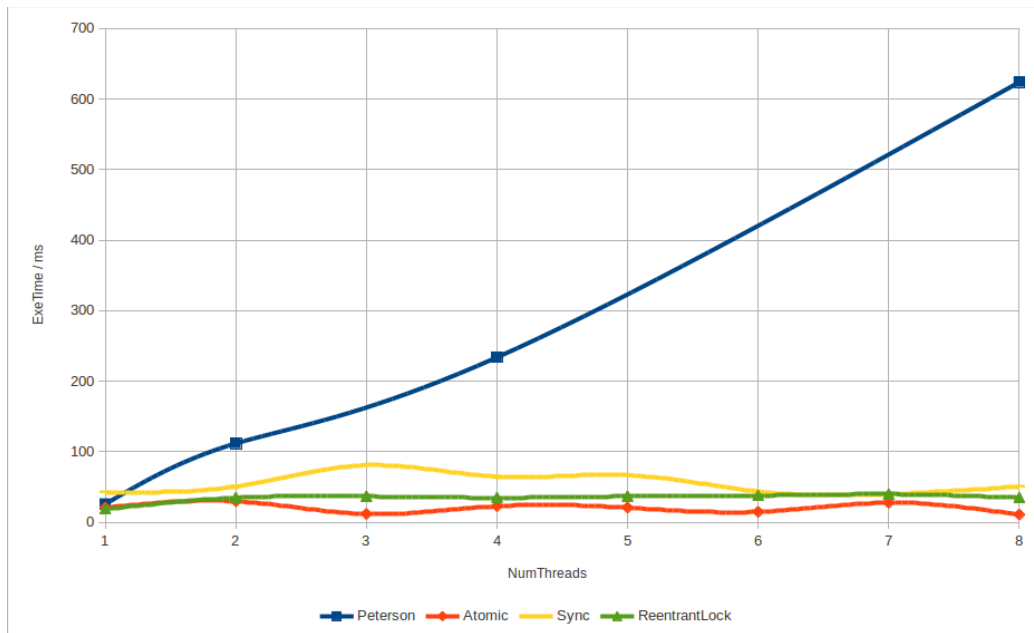


Figure 1: Execution time using the four methods

## Question 5

\* Code submitted on Canvas. The execution time plot is shown in Fig 1.