

Parallel Programming Exercise 4 – 9

Author:	林子傑 (r10525069@ntu.edu.tw)
Student ID	R10525069
Department	Engineering Science and Ocean Engineering

(If you and your team member contribute equally, you can use (co-first author), after each name.)

1 Problem and Proposed Approach

(Brief your problem, and give your idea or concept of how you design your program.)

Problem: 找出 1 到 n 所有相鄰兩質數的最大差距。

Proposed Approach: 每個 processor 負責 in/p 到 $(i+1)n/p-1$ 的範圍，如果邊界是偶數，就往外 $+1$ 或 -1 。每個 processor 維護一個變數 mx ，記錄區間內兩質數的最大差距，利用迴圈判斷每個奇數是不是質數，如果是質數就記錄起來，並計算該質數和前一個質數差距 d ，如果 d 大於 mx 就更新 mx ，最後用 reduction 將所有 processor 的 mx 取最大值。

2 Theoretical Analysis Model

(Try to give the time complexity of the algorithm, and analyze your program with iso-efficiency metrics)

Sequential algorithm complexity : $\Theta(n\sqrt{n})$

Parallel computational complexity : $\Theta(n\sqrt{n/p})$

Parallel communication complexity : $\Theta(\log p)$

Parallel overhead : $T_o(n, p) = \Theta(p \log p)$

Iso-efficiency relation : $p \geq Cp \log p$

$M(n)=1$

$M(Cp \log p)/p = C \log p / p$

3 Performance Benchmark

(Give your idea or concept of how you design your program.)

The time to determine whether a number x is prime : χ

Sequential execution time : $n\chi$

Parallel :

The computation time for each process: $\chi \lceil n/p \rceil$

Necessary communication time : λ

Parallel execution time : $\chi \lceil n/p \rceil + \lambda$

Table 1. The execution time

Processors	1	2	3	4	5	6	7	8
Real execution time	0.173897	0.106471	0.074365	0.056828	0.045918	0.038554	0.033222	0.029277
Estimate execution time	0.15	0.075	0.05	0.0375	0.03	0.025	0.021429	0.01875
Speedup		1.63328	2.338425	3.060058	3.787121	4.510479	5.234393	5.939714
Karp-flatt metrics		0.224529	0.141457	0.102388	0.080066	0.066047	0.056218	0.049552

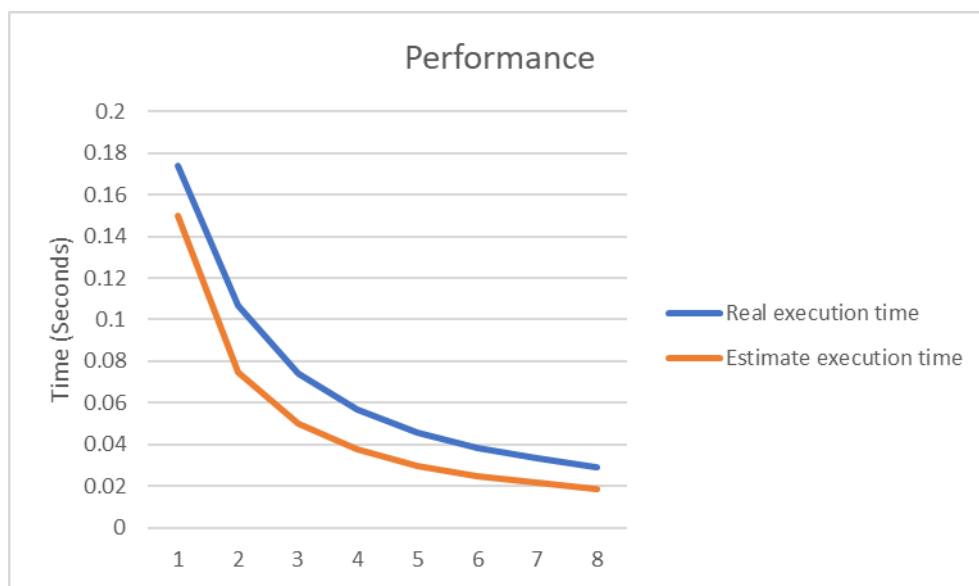


Figure 1. The performance of diagram

4 Conclusion and Discussion

(Discuss the following issues of your program

1. What is the speedup respect to the number of processors used?
2. How can you improve your program further more
3. How does the communication and cache affect the performance of your program?
4. How does the Karp-Flatt metrics and Iso-efficiency metrics reveal?

)

從 speedup 的數據來看，當 processor 增加，speedup 的數據也會增加，本問題適合用平行計算。
從 Iso-efficiency metrics 顯示出這個程式有很好的 Scalability。

Appendix(optional):

(If something else you want to append in this file, like picture of life game)