Parallel Programming Exercise 9 – 10

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(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: 找出前八個完全數。

Proposed Approach: 設立一個 manager process，其他 process 當 worker，worker 每次都和 manager 拿一個數字 n 去判斷是否 2^n-1 為質數，如果是質數，就直接回傳該數字，否則回傳 0。Manager 一次給一個數字，如果找到八個答案，就會傳送 0 給每個 worker，表示要停止搜尋。

(一個偶數是完美數，若且唯若它具有如下形式：$2^{n-1}*(2^n-1)$，其中 2^n-1 是質數**)**

2 Theoretical Analysis Model

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

Sequential algorithm complexity： $\Theta(n)$

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

Parallel communication complexity： $\Theta(n)$

Parallel overhead：$To(n, p) = \Theta(np)$

Iso-efficiency relation：n>=Cpn

M(n)=1

M(Cpn)/p= Cpn/p=Cn

3 Performance Benchmark

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

The time to perform determine if it is a perfect number：χ

Sequential execution time：$n\chi$

Parallel：

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

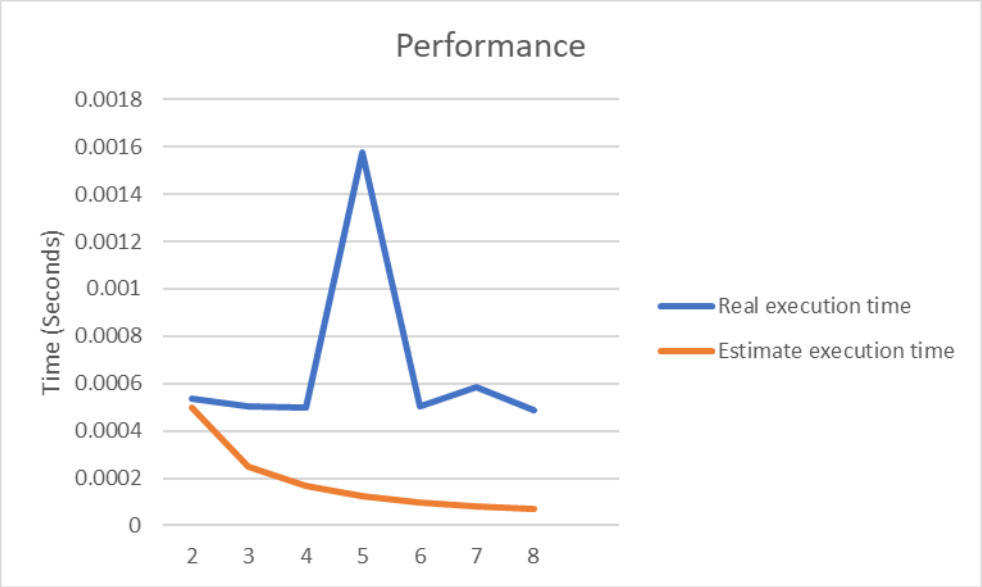
Need to send a number 2n times.

Sending a number requires time：λ

Parallel execution time： $\chi(\lceil n/p \rceil)+2n\lambda$

Table 1. The execution time

Processors	2	3	4	5	6	7	8
Real execution time	0.000538	0.000505	0.000501	0.001579	0.000503	0.000585	0.000489
Estimate execution time	0.0005	0.00025	0.0001666 7	0.000125	0.0001	8.3333E-05	7.1429E-05
Speedup		1.06534653	1.0738523	1.0695825	0.91965812	1.1002045	1.1002045
Karp-flatt metrics		0.87732342	0.89684015	0.91325898	1.10920074	0.89070632	0.89374226



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 效果有限，本問題不適合用平行計算。

從 Iso-efficiency metrics 顯示出這個程式有不錯的 Scalability。

Appendix(optional):

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