Parallel Programming Exercise 10 – 4

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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: 一個立方體內部有球體，請算出立方體扣去球體的體積。

Proposed Approach：使用 Monte Carlo Methods 推估體積，假設要隨機生成 n 個點，每個 process 負責隨機生成 ⌈n/p⌉ 個點，計算在球體外部的個數 cnt，最後將 每個 process 計算的 cnt reduction 到 global_cnt，最終推估體積為 global_cnt/N。

2 Theoretical Analysis Model

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

Sequential algorithm complexity： Θ(n)

Parallel computational complexity： Θ(n/p)

Parallel communication complexity： Θ(log p)

Parallel overhead：To(n, p) =Θ(p log p)

Iso-efficiency relation：p>=Cp log p

M(n)=1

M(Cp log p)/p=1/p

3 Performance Benchmark

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

The time to generate point：χ

Sequential execution time：nχ

Parallel：

The computation time for each process: ⌈n/p⌉ χ

A reduction of p values distributed among p tasks can be preformed in ⌈log p⌉ communication steps.

Parallel execution time：(⌈n/p⌉) χ + ⌈log p⌉ λ

Table 1. The execution time

Processors	1	2	3	4	5	6	7	8

Real execution time	114.6491	110.4272	37.3637	28.3306	22.7218	21.4782	33.154	29.0298
Estimate execution time	114	57	38	28.5	22.8	19	16.28571	14.25
Speedup		1.038232	3.068462	4.046829	5.045775	3.458077	3.949359	3.949359
Karp-flatt metrics		0.926351	-0.011156	-0.003857	-0.002268	0.147014	0.12874	0.146521

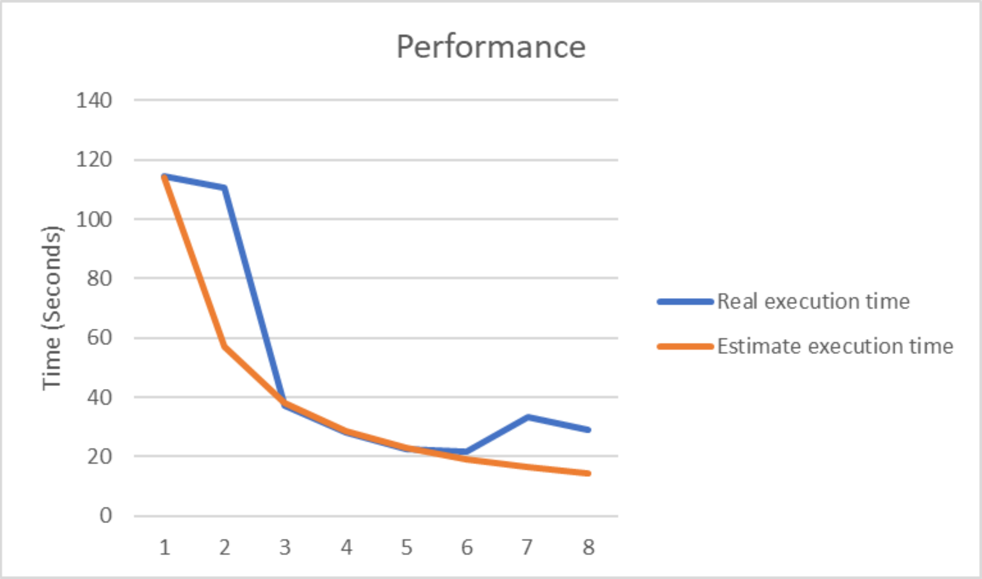

Figure 1. The performance of diagram

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)