Parallel Programming Exercise 4 – 8

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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

計算 1~10^6 中，有幾對相鄰的奇數恰好都是質數。

我修改 sieve 的 sample code，讓每個 processor 自己計算組內共有幾對。
但這樣做是不對的，還需要 handle 兩個相鄰奇數在不同 processor 的問題，我的做法是，除了第一個 processor 以外，把每個 processor 的左界+2，這樣就能確保算到臨界的點。

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

2 Theoretical Analysis Model

Same as sieve version 1

- χ is time needed to mark a cell
- Sequential execution time: $\chi n \ln \ln n$
- Number of broadcasts: $\sqrt{n}/\ln\sqrt{n}$
- Broadcast time: $\lambda\lceil \log p \rceil$
- Expected execution time:

$$\chi n \ln \ln n / p + \left(\sqrt{n}/\ln\sqrt{n}\right)\lambda\lceil \log p \rceil$$

$$n^{\frac{3}{2}} > C\ plogp$$

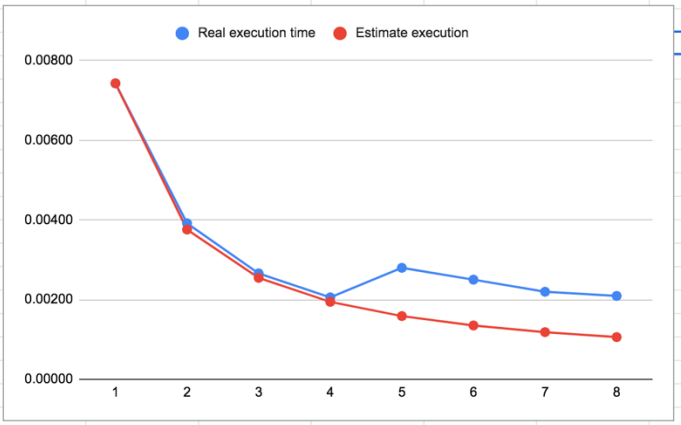
$$n > (Cplogp)^{\frac{2}{3}}$$

$$\frac{M(f(p))}{p} = \frac{Cplogp^{\frac{2}{3}}}{p}$$

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

3 Performance Benchmark

Processors	1	2	3	4	5	6	7	8
Real execution time	0.00743	0.00392	0.00266	0.00206	0.00280	0.00250	0.00220	0.00209
Estimate execution time	0.00743	0.00376	0.00255	0.00194	0.00159	0.00135	0.00118	0.00106
Speedup	X	1.89658	2.79316	3.61060	2.65440	2.96961	3.38052	3.54849
Karp-flatt metrics	X	0.05453	0.03703	0.03595	0.22092	0.20409	0.17845	0.17921



xnlnln(n)/p + sqrt

x

0.000000002829

Figure 1. The performance of diagram

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

4 Conclusion and Discussion

1. Speedup 未必隨著 p 增加持續上升
2. 可以套用 sieve 的 improve 方法，例如把偶數去掉
3. 由圖中可觀察得知，當 p 越大時，時間未必越短，因為 communication 所花的時間也上升了
4. K 值上升，告訴我們 overhead 是影響速度的主因。他有良好的 scalability。

(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?

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Appendix(optional):

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