Parallel Programming Exercise 4 – 9

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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，相鄰的質數間最大的 gap 是多少。

我修改 sieve 的 sample code，讓每個 processors 計算自己組內的最大 gap，但這樣是不對的，因為有可能兩個質數在不同 processor，所以我將左界加上一個值(此處用 200)，來處理這個情況。

(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:

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

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

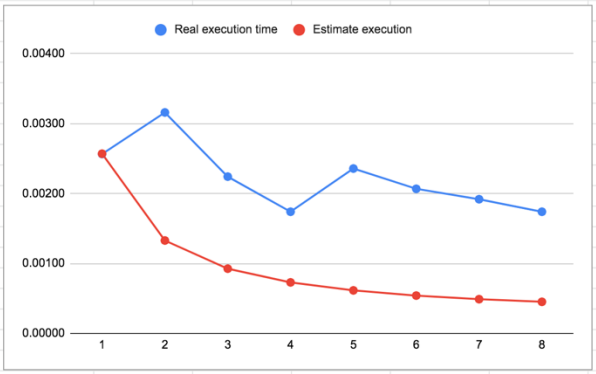
$$n^{\frac{3}{2}} > C\ plogp$$

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

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

3 Performance Benchmark

	A	B	C	D	E	F	G	H	I
1	Processors	1	2	3	4	5	6	7	8
2	Real execution time	0.00257	0.00316	0.00224	0.00174	0.00236	0.00207	0.00192	0.00174
3	Estimate execution time	0.00257	0.00133	0.00093	0.00073	0.00062	0.00054	0.00049	0.00045
4	Speedup	X	0.81203	1.14451	1.47471	1.08821	1.24081	1.33715	1.47471
5	Karp-flatt metrics	X	1.46298	0.81060	0.57080	0.89867	0.76711	0.70583	0.63211



xnlnln(n)/p + sqrt

x

0.000000000978

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)