

2022 NYCU OS HW2 report

Question	Answer
<p>Q1. (5pts)</p> <p>Briefly describe your design for the add, multiple function of matrix, the thread management.</p> <p>Also, describe the number of threads in the Multi-thread program.</p>	<p>將複雜度最高的矩陣乘法 $O(n^3)$ 以最外層的迴圈分成 n 份，main 先開 $n-1$ 個 thread 處理前 $n-1$ 份，main 再處理最後一份及矩陣加法、輸出加法答案，再 thread join，最後輸出乘法答案。在自己電腦跑時，基本上 thread 越多越快，然而在工作站則是 4 個 thread 最好。lscpu 可以得知工作站 CPU 最多支援 4 個 thread，再多硬體不支援，實際上也不是平行運算，還要增加切換所耗費時間。</p>
<p>Q2. (15pts)</p> <p>Try at least 3 kinds of number of threads, and compare the difference in time.(Take screenshots of the time of each case)</p> <p>Also, explain the results.</p>	 <p>上圖分別為 2、10、20 個 thread 在本機的結果，基本上越多 thread 效率越好，但變好的幅度降低，下方附有更詳盡的結果，當 thread 數量碰上硬體限制也就不降反升，且 thread 到一定數量能增加的速率便不划算。</p>
<p>Q3. (10pts)</p> <p>Show the best speedup between multi-thread and single-thread. (Take screenshots of the time of single-thread and multi-thread)</p> <p>Also, explain why multi-thread is faster.</p>	 <p>Speedup: $0.511 / 0.110 = 4.645$</p> <p>在硬體支援的情況下 multi thread 可以同時運作，即可以平行進行運算，自然可以比 Single thread 更快算出結果。</p>

Script 執行 Single thread 與 2~20 個的 Multi thread 結果：

本機	工作站
Single thread:	Single thread:
real 0m0.506s user 0m0.478s sys 0m0.000s	real 0m0.979s user 0m0.712s sys 0m0.004s
Multi thread:	Multi thread:
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Thread number: 2	Thread number: 2
real 0m0.257s user 0m0.439s sys 0m0.000s	real 0m0.632s user 0m0.582s sys 0m0.008s
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Thread number: 3	Thread number: 3
real 0m0.202s user 0m0.483s sys 0m0.000s	real 0m0.285s user 0m0.649s sys 0m0.008s
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Thread number: 4	Thread number: 4
real 0m0.158s user 0m0.462s sys 0m0.000s	real 0m0.213s user 0m0.615s sys 0m0.006s
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Thread number: 5	Thread number: 5
real 0m0.149s user 0m0.489s sys 0m0.000s	real 0m0.400s user 0m0.603s sys 0m0.006s
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Thread number: 6	Thread number: 6
real 0m0.165s user 0m0.634s sys 0m0.000s	real 0m0.362s user 0m0.597s sys 0m0.005s
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Thread number: 7	Thread number: 7
real 0m0.138s user 0m0.576s sys 0m0.000s	real 0m0.187s user 0m0.571s sys 0m0.014s
-----	-----
Thread number: 8	Thread number: 8
real 0m0.135s user 0m0.600s sys 0m0.018s	real 0m0.328s user 0m0.579s sys 0m0.006s
-----	-----
Thread number: 9	Thread number: 9
real 0m0.121s user 0m0.622s sys 0m0.000s	real 0m0.267s user 0m0.574s sys 0m0.009s
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Thread number: 10	Thread number: 10
real 0m0.110s user 0m0.662s sys 0m0.000s	real 0m0.308s user 0m0.580s sys 0m0.007s
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Thread number: 11	Thread number: 11
real 0m0.116s user 0m0.730s sys 0m0.000s	real 0m0.362s user 0m0.578s sys 0m0.005s
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<p>Thread number: 12</p> <p>real 0m0.112s user 0m0.781s sys 0m0.000s</p> <p>-----</p> <p>Thread number: 13</p> <p>real 0m0.116s user 0m0.733s sys 0m0.010s</p> <p>-----</p> <p>Thread number: 14</p> <p>real 0m0.126s user 0m0.792s sys 0m0.000s</p> <p>-----</p> <p>Thread number: 15</p> <p>real 0m0.123s user 0m0.718s sys 0m0.009s</p> <p>-----</p> <p>Thread number: 16</p> <p>real 0m0.124s user 0m0.770s sys 0m0.000s</p> <p>-----</p> <p>Thread number: 17</p> <p>real 0m0.124s user 0m0.753s sys 0m0.009s</p> <p>-----</p> <p>Thread number: 18</p> <p>real 0m0.121s user 0m0.752s sys 0m0.000s</p> <p>-----</p> <p>Thread number: 19</p> <p>real 0m0.123s user 0m0.812s sys 0m0.009s</p> <p>-----</p> <p>Thread number: 20</p> <p>real 0m0.117s user 0m0.821s sys 0m0.000s</p>	<p>Thread number: 12</p> <p>real 0m0.205s user 0m0.586s sys 0m0.007s</p> <p>-----</p> <p>Thread number: 13</p> <p>real 0m0.185s user 0m0.580s sys 0m0.006s</p> <p>-----</p> <p>Thread number: 14</p> <p>real 0m0.190s user 0m0.577s sys 0m0.007s</p> <p>-----</p> <p>Thread number: 15</p> <p>real 0m0.334s user 0m0.576s sys 0m0.005s</p> <p>-----</p> <p>Thread number: 16</p> <p>real 0m0.191s user 0m0.568s sys 0m0.010s</p> <p>-----</p> <p>Thread number: 17</p> <p>real 0m0.207s user 0m0.594s sys 0m0.005s</p> <p>-----</p> <p>Thread number: 18</p> <p>real 0m0.315s user 0m0.572s sys 0m0.011s</p> <p>-----</p> <p>Thread number: 19</p> <p>real 0m0.218s user 0m0.589s sys 0m0.004s</p> <p>-----</p> <p>Thread number: 20</p> <p>real 0m0.345s user 0m0.594s sys 0m0.007s</p>
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