

# NCTU OS HW2 report 2018

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Question	Answer																																																																																																																																																																																																																																																																								
<p>Q1.</p> <p>Briefly describe about your design for the problem "Sum Checker" and total num of threads you used in your code.</p>	<p><b>Single-thread:</b> Use only one thread and three functions. One function loop from first row to last row and check if the sum for each row is same. Another function do the same operation on each column. Last function checks if each subgrid sum is same. Finally compare the sum result returned from each function. If is same then print "Successfully" .</p> <p><b>Multi-thread:</b> Use 12 thread in total and three function. Functions are the same as single-threaded version. Distribute one thread to check row sum, one thread to check column sum, nine threads to check all subgrid, one thread for main function.</p>																																																																																																																																																																																																																																																																								
<p>Q2.</p> <p>Show your thread info screenshots while "Sum Checker" code running.</p>	<p><b>Single-thread:</b></p> <pre>last pid: 68871; load averages: 0.43, 0.29, 0.21 211 processes: 1 running, 243 sleeping, 67 stopped CPU: 0.8% user, 0.0% nice, 0.2% system, 0.0% interrupt, 99.8% idle Mem: 212M Active, 2857M Inact, 85M Laundry, 116 Wired, 84M Buf, 1920M Free ARC: 6749M Total, 4444M MFU, 1715M MRU, 294K Anon, 93M Header, 498M Other 5505M Compressed, 136 Uncompressed, 2.48:1 Ratio Swap: 2848M Total, 35M Used, 2813M Free, 1% Inuse</pre> <table><tr><th>PID</th><th>USERNAME</th><th>THR</th><th>PRI</th><th>NICE</th><th>SIZE</th><th>RES</th><th>STATE</th><th>C</th><th>TIME</th><th>WCPU</th><th>COMMAND</th></tr><tr><td>68824</td><td>ctay9797</td><td>1</td><td>20</td><td>0</td><td>16868K</td><td>6692K</td><td>CPU3</td><td>3</td><td>0:00</td><td>0.22%</td><td>top</td></tr><tr><td>68870</td><td>ywu0603</td><td>1</td><td>20</td><td>0</td><td>62576K</td><td>4248K</td><td>select</td><td>0</td><td>0:00</td><td>0.19%</td><td>vim</td></tr><tr><td>651</td><td>root</td><td>1</td><td>20</td><td>0</td><td>54196K</td><td>45128K</td><td>select</td><td>3</td><td>40:18</td><td>0.19%</td><td>vmtoolsd</td></tr><tr><td>69391</td><td>ycliang</td><td>1</td><td>20</td><td>0</td><td>10336K</td><td>6632K</td><td>select</td><td>0</td><td>0:02</td><td>0.04%</td><td>tmux</td></tr><tr><td>22613</td><td>root</td><td>1</td><td>20</td><td>0</td><td>6424K</td><td>2616K</td><td>select</td><td>2</td><td>7:57</td><td>0.04%</td><td>syslogd</td></tr><tr><td>53388</td><td>ywu0603</td><td>1</td><td>20</td><td>0</td><td>33644K</td><td>28896K</td><td>select</td><td>1</td><td>0:01</td><td>0.02%</td><td>sshd</td></tr><tr><td>99277</td><td>ctay9797</td><td>1</td><td>20</td><td>0</td><td>33644K</td><td>28492K</td><td>select</td><td>2</td><td>0:00</td><td>0.02%</td><td>sshd</td></tr><tr><td>369</td><td>root</td><td>1</td><td>20</td><td>0</td><td>9184K</td><td>620K</td><td>select</td><td>1</td><td>4:50</td><td>0.01%</td><td>devd</td></tr><tr><td>6211</td><td>ycliang</td><td>1</td><td>20</td><td>0</td><td>35692K</td><td>28896K</td><td>select</td><td>3</td><td>0:02</td><td>0.01%</td><td>sshd</td></tr><tr><td>53460</td><td>ywu0603</td><td>1</td><td>20</td><td>0</td><td>33644K</td><td>28816K</td><td>select</td><td>3</td><td>0:00</td><td>0.01%</td><td>sshd</td></tr><tr><td>603</td><td>root</td><td>1</td><td>20</td><td>0</td><td>12456K</td><td>12552K</td><td>select</td><td>3</td><td>3:16</td><td>0.01%</td><td>ntpd</td></tr><tr><td>302</td><td>root</td><td>1</td><td>20</td><td>0</td><td>6480K</td><td>1048K</td><td>hpf</td><td>3</td><td>2:10</td><td>0.00%</td><td>ntdoad</td></tr><tr><td>68871</td><td>ctay9797</td><td>1</td><td>20</td><td>0</td><td>6288K</td><td>2688K</td><td>nanslp</td><td>1</td><td>0:00</td><td>0.00%</td><td>test1</td></tr></table> <p><b>Multi-thread:</b></p> <pre>last pid: 99833; load averages: 0.26, 0.26, 0.21 239 processes: 1 running, 237 sleeping, 1 stopped CPU: 0.0% user, 0.0% nice, 0.4% system, 0.0% interrupt, 99.6% idle Mem: 250M Active, 2708M Inact, 85M Laundry, 116 Wired, 85M Buf, 2036M Free ARC: 6754M Total, 4444M MFU, 1719M MRU, 302K Anon, 93M Header, 498M Other 5506M Compressed, 136 Uncompressed, 2.48:1 Ratio Swap: 2848M Total, 35M Used, 2813M Free, 1% Inuse</pre> <table><tr><th>PID</th><th>USERNAME</th><th>THR</th><th>PRI</th><th>NICE</th><th>SIZE</th><th>RES</th><th>STATE</th><th>C</th><th>TIME</th><th>WCPU</th><th>COMMAND</th></tr><tr><td>99766</td><td>cyuo6004</td><td>1</td><td>20</td><td>0</td><td>62576K</td><td>42936K</td><td>select</td><td>2</td><td>0:00</td><td>0.58%</td><td>vim</td></tr><tr><td>99830</td><td>ctay9797</td><td>1</td><td>20</td><td>0</td><td>16868K</td><td>6344K</td><td>CPU1</td><td>1</td><td>0:00</td><td>0.23%</td><td>top</td></tr><tr><td>651</td><td>root</td><td>1</td><td>20</td><td>0</td><td>54196K</td><td>45172K</td><td>select</td><td>3</td><td>40:21</td><td>0.12%</td><td>vmtoolsd</td></tr><tr><td>67752</td><td>cyuo6004</td><td>1</td><td>20</td><td>0</td><td>33644K</td><td>28472K</td><td>select</td><td>0</td><td>0:10</td><td>0.08%</td><td>sshd</td></tr><tr><td>22613</td><td>root</td><td>1</td><td>20</td><td>0</td><td>6424K</td><td>2616K</td><td>select</td><td>3</td><td>7:58</td><td>0.04%</td><td>syslogd</td></tr><tr><td>99833</td><td>ctay9797</td><td>12</td><td>20</td><td>0</td><td>7876K</td><td>2584K</td><td>uwait</td><td>0</td><td>0:00</td><td>0.02%</td><td>test2</td></tr><tr><td>369</td><td>root</td><td>1</td><td>20</td><td>0</td><td>9184K</td><td>620K</td><td>select</td><td>0</td><td>4:50</td><td>0.01%</td><td>devd</td></tr></table>	PID	USERNAME	THR	PRI	NICE	SIZE	RES	STATE	C	TIME	WCPU	COMMAND	68824	ctay9797	1	20	0	16868K	6692K	CPU3	3	0:00	0.22%	top	68870	ywu0603	1	20	0	62576K	4248K	select	0	0:00	0.19%	vim	651	root	1	20	0	54196K	45128K	select	3	40:18	0.19%	vmtoolsd	69391	ycliang	1	20	0	10336K	6632K	select	0	0:02	0.04%	tmux	22613	root	1	20	0	6424K	2616K	select	2	7:57	0.04%	syslogd	53388	ywu0603	1	20	0	33644K	28896K	select	1	0:01	0.02%	sshd	99277	ctay9797	1	20	0	33644K	28492K	select	2	0:00	0.02%	sshd	369	root	1	20	0	9184K	620K	select	1	4:50	0.01%	devd	6211	ycliang	1	20	0	35692K	28896K	select	3	0:02	0.01%	sshd	53460	ywu0603	1	20	0	33644K	28816K	select	3	0:00	0.01%	sshd	603	root	1	20	0	12456K	12552K	select	3	3:16	0.01%	ntpd	302	root	1	20	0	6480K	1048K	hpf	3	2:10	0.00%	ntdoad	68871	ctay9797	1	20	0	6288K	2688K	nanslp	1	0:00	0.00%	test1	PID	USERNAME	THR	PRI	NICE	SIZE	RES	STATE	C	TIME	WCPU	COMMAND	99766	cyuo6004	1	20	0	62576K	42936K	select	2	0:00	0.58%	vim	99830	ctay9797	1	20	0	16868K	6344K	CPU1	1	0:00	0.23%	top	651	root	1	20	0	54196K	45172K	select	3	40:21	0.12%	vmtoolsd	67752	cyuo6004	1	20	0	33644K	28472K	select	0	0:10	0.08%	sshd	22613	root	1	20	0	6424K	2616K	select	3	7:58	0.04%	syslogd	99833	ctay9797	12	20	0	7876K	2584K	uwait	0	0:00	0.02%	test2	369	root	1	20	0	9184K	620K	select	0	4:50	0.01%	devd
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**Q3.**

**Compare the time between Single-thread and Multi-thread.**

**Single-thread:**

```
bsd1 [/u/cs/105/0516244] -ctay9797- time ./test1
=====
|| SUM  CHECKER ||
=====
|8 ||5 ||2 ||7 ||3 ||6 ||4 ||9 ||1 |
|-----|
|3 ||1 ||7 ||4 ||2 ||9 ||6 ||8 ||5 |
|-----|
|9 ||4 ||6 ||5 ||8 ||1 ||2 ||7 ||3 |
|-----|
|1 ||6 ||8 ||3 ||5 ||4 ||9 ||2 ||7 |
|-----|
|5 ||2 ||4 ||8 ||9 ||7 ||1 ||3 ||6 |
|-----|
|7 ||3 ||9 ||1 ||6 ||2 ||8 ||5 ||4 |
|-----|
|2 ||8 ||3 ||6 ||4 ||5 ||7 ||1 ||9 |
|-----|
|6 ||7 ||5 ||9 ||1 ||8 ||3 ||4 ||2 |
|-----|
|4 ||9 ||1 ||2 ||7 ||3 ||5 ||6 ||8 |
|-----|

Successful :)
0.000u 0.003s 0:00.00 0.0%      0+0k 0+0io 0pf+0w
```

**Multi-thread:**

```
bsd1 [/u/cs/105/0516244] -ctay9797- time ./test2
=====
|| SUM  CHECKER ||
=====
|8 ||5 ||2 ||7 ||3 ||6 ||4 ||9 ||1 |
|-----|
|3 ||1 ||7 ||4 ||2 ||9 ||6 ||8 ||5 |
|-----|
|9 ||4 ||6 ||5 ||8 ||1 ||2 ||7 ||3 |
|-----|
|1 ||6 ||8 ||3 ||5 ||4 ||9 ||2 ||7 |
|-----|
|5 ||2 ||4 ||8 ||9 ||7 ||1 ||3 ||6 |
|-----|
|7 ||3 ||9 ||1 ||6 ||2 ||8 ||5 ||4 |
|-----|
|2 ||8 ||3 ||6 ||4 ||5 ||7 ||1 ||9 |
|-----|
|6 ||7 ||5 ||9 ||1 ||8 ||3 ||4 ||2 |
|-----|
|4 ||9 ||1 ||2 ||7 ||3 ||5 ||6 ||8 |
|-----|

Successful :)
0.000u 0.006s 0:00.00 0.0%      0+0k 0+0io 0pf+0w
```

**Time taken in multi-thread is longer since it need to collect information from all thread while sum-checker is just an easy job.**

**Q4.**

**What you learned from doing OS hw2 or some improvements you want to say to TAs.**

**Learn to use pthread for multi-thread programming.  
Hope TA can describe the problem in more detail.**

p.s You can reference to homework info pdf and show your answer as the format for Q2 and Q3.