

OS Project 1 Report

Group 13

1. 設計：

整體架構設計：

Parent process 的 priority 為 2。

API:

`make(TSK *tsk):`

fork 出一個 process，由於 priority 為 1，所以還不會跑，並將 tsk -> pid 被設成該 process 的 pid，在 task ready 時呼叫。

`run(TSK *tsk, int run_time):`

讓 tsk -> pid 的 process 的 priority 上升為 3 後，跑 run_time 單位時間，結束後其 priority 重新設為 1。

`clear(TSK *tsk):`

收屍。

整體架構:

在整個執行過程中，會有三種動作，(1)wait,(2)run,(3)make。因此在各個演算法中，只要將可以 input 轉化為指令，指令包含了是屬於哪一個動作、以及要執行多久、對哪一個 pid 執行。預先將這些都處理好，如此一來最後只要將每一個指令依序執行，即可達成指定的成果。

利用 sched 中的 FIFO 模式實現 real time 排程，藉由調整不同 process 的優先度來決定現在該執行哪個 process。scheduler 和 process 都在同一顆 CPU 上運行。

FIFO 設計方法：

先照 arrive time 由小到大排好，看下一個 task 要 wait 多久，以及是否需要 make(可能之前在跑其他 task 時已經先 make 了)。然後去看在跑這個 task 時，是否有其他 task arrive，有的話就必須中斷 run，去 make。譬如說

FIFO
p1 0 5
p2 2 5
就會是
make(p1)
run(p1, 2)
make(p2)
run(p1, 3)
run(p2, 5)

SJF 設計方法：

大致與 FIFO 一樣，只是多了需要去記錄目前有幾個 task 是已經 arrive，但尚未執行的。對這些 task 已執行時間長短去 sort，比較小的即是下一個要執行的 task。

PSJF 設計方法：

先照 arrival time 及 task time 由小排到大，再開一個約略 4000 的陣列去預處理此刻應該要空等、make、還是 run process。在下一個 task arrive 前，都是用 SJF 來決定哪一個 process 先跑，如果先行能跑的 process 都跑完了，就會記錄要空等；如果超過下一個 task arrival time 就先把正在跑的 process 停止，然後再去檢查以 SJF 哪一個 process 先跑。

RR 設計方法：

利用雙指標維護 queue(fifo)，每次將頭取出並檢查這段時間(500 單位時間)內有無其他 task 開始，若有則將其排入 queue，結束後若還有剩餘所需執行時間則再將其排入 queue。

2. 執行範例結果：

(以下 Output 中的紅色時間是代表總過程的頭尾)

input:

FIFO

10

P0 0 500

P1 1000 500

P2 2000 500

P3 3000 500

P4 4000 500

P5 5000 500

P6 6000 500

P7 7000 500

P8 8000 500

P9 9000 500

Output:

[Project1] 25090 1556535551.998336599, 1556535552.671563721
[Project1] 25091 1556535553.332428659, 1556535553.989236285
[Project1] 25092 1556535554.654427455, 1556535555.317614491
[Project1] 25093 1556535555.980587039, 1556535556.641470316
[Project1] 25094 1556535557.309442976, 1556535557.969548889
[Project1] 25095 1556535558.631236361, 1556535559.288489485
[Project1] 25096 1556535559.953183164, 1556535560.609638149
[Project1] 25097 1556535561.278671390, 1556535561.940674030
[Project1] 25098 1556535562.604337024, 1556535563.261824970
[Project1] 25099 1556535563.924977916, 1556535564.591205631

P0 25090 -1556535551.998336599 + 1556535552.671563721 = 0.673

P1 25091 -1556535553.332428659 + 1556535553.989236285 = 0.657

P2 25092 -1556535554.654427455 + 1556535555.317614491 = 0.663

P3 25093 -1556535555.980587039 + 1556535556.641470316 = 0.661

P4 25094 -1556535557.309442976 + 1556535557.969548889 = 0.660

P5 25095 -1556535558.631236361 + 1556535559.288489485 = 0.657

P6 25096 -1556535559.953183164 + 1556535560.609638149 = 0.656

P7 25097 -1556535561.278671390 + 1556535561.940674030 = 0.662

P8 25098 -1556535562.604337024 + 1556535563.261824970 = 0.658

P9 25099 -1556535563.924977916 + 1556535564.591205631 = 0.666

Average of ten:

$$\begin{aligned} & (0.673+0.657+0.663+0.661+0.660+0.657+0.656+ 0.662+0.658+ 0.666)/10 \\ & = 0.661 \end{aligned}$$

500 units 跑 0.661 秒 => 1000 units 跑 1.322 秒

FIFO:

FIFO_1:

FIFO

5

P1 0 500

P2 0 500

P3 0 500

P4 0 500

P5 0 500

理論總時間：(500+500+500+500+500)/1000 * 1.322 = 3.305

Output:

[Project1] 24363 1556534522.138770991, 1556534522.829885256
[Project1] 24364 1556534522.830428149, 1556534523.499013848
[Project1] 24365 1556534523.499561899, 1556534524.172957258
[Project1] 24366 1556534524.173507756, 1556534524.847395712
[Project1] 24367 1556534524.848018725, 1556534525.518356554

P1 24363 -1556534522.138770991+1556534522.829885256 = 0.691

P2 24364 -1556534522.830428149+1556534523.499013848 = 0.669

P3 24365 -1556534523.499561899+1556534524.172957258 = 0.673

P4 24366 -1556534524.173507756+1556534524.847395712 = 0.674

P5 24367 -1556534524.848018725+1556534525.518356554 = 0.670

實際總時間：(0.691+0.699+0.673+0.674+0.670) = 3.377

誤差值：((3.377/3.305)-1)*100% = 2.179%

FIFO_2:

FIFO

7

P1 0 8000

P2 200 5000

P3 200 3000

P4 400 1000

P5 400 1000

P6 600 1000

P7 600 4000

理論總時間：(8000+5000+3000+1000+1000+1000+4000)/1000 * 1.322 = 30.406

Output:

[Project1] 24395	1556534674.617597513,	1556534685.293716468
[Project1] 24396	1556534685.294490037,	1556534691.986718805
[Project1] 24397	1556534691.987406856,	1556534696.005385054
[Project1] 24398	1556534696.006046100,	1556534697.402359381
[Project1] 24399	1556534697.403004292,	1556534698.727871610
[Project1] 24400	1556534698.728529099,	1556534700.058752524
[Project1] 24401	1556534700.059402966,	1556534705.364413990

P1 24395 -1556534674.617597513+1556534685.293716468 = 10.676

P2 24396 -1556534685.294490037+1556534691.986718805 = 6.692

P3 24397 -1556534691.987406856+1556534696.005385054 = 4.018

P4 24398 -1556534696.006046100+1556534697.402359381 = 1.396

P5 24399 -1556534697.403004292+1556534698.727871610 = 1.325

P6 24400 -1556534698.728529099+1556534700.058752524 = 1.330

P7 24401 -1556534700.059402966+1556534705.364413990 = 5.305

實際總時間: 10.676+6.692+4.018+1.396+1.325+1.330+5.305=30.742

誤差值：((30.742/30.406)-1)*100% = 1.105%

SJF:

SJF_1:

SJF

4

P1 0 7000

P2 0 2000

P3 100 1000

P4 200 4000

理論總時間：(7000+2000+1000+4000)/1000 * 1.322 = 18.508

Output:

[Project1] 24993 1556535146.286704296, 1556535148.953745070

[Project1] 24995 1556535148.954390291, 1556535150.266005773

[Project1] 24996 1556535150.266581381, 1556535155.558483757

[Project1] 24994 1556535155.559100332, 1556535164.802275726

P1 24994 -1556535146.286704296+1556535148.953745070 = 2.667

P2 24993 -1556535148.954390291+1556535150.266005773 = 1.312

P3 24995 -1556535150.266581381+1556535155.558483757 = 5.292

P4 24996 -1556535155.559100332+1556535164.802275726 = 9.243

實際總時間： -1556535146.286704296 + 1556535164.802275726 = 18.516

誤差值：((18.516/18.508)-1)*100% = 0.043%

SJF_2:

SJF

5

P1 0 3000

P2 1000 1000

P3 2000 4000

P4 5000 2000

P5 7000 1000

理論總時間：(3000+1000+4000+2000+1000)/1000 * 1.322 = 14.542

Output:

[Project1]	25020	1556535227.433032474,	1556535231.386112519
[Project1]	25021	1556535231.386632316,	1556535232.727497747
[Project1]	25022	1556535232.728113955,	1556535238.019146097
[Project1]	25024	1556535238.019756869,	1556535239.460855064
[Project1]	25023	1556535239.461431095,	1556535242.327025618

P1 25020 -1556535227.433032474+1556535231.386112519 = 3.953

P2 25021 -1556535231.386632316+1556535232.727497747 = 1.341

P3 25022 -1556535232.728113955+1556535238.019146097 = 5.291

P4 25023 -1556535238.019756869+1556535239.460855064 = 1.441

P5 25024 -1556535239.461431095+1556535242.327025618 = 2.866

實際總時間: $-1556535227.433032474 + 1556535242.327025618 = 14.893$

誤差值 : $((14.893/14.542)-1)*100\% = 2.413\%$

PSJF:

PSJF_1:

PSJF

5

P1 0 3000

P2 1000 1000

P3 2000 4000

P4 5000 2000

P5 7000 1000

理論總時間：(3000+1000+4000+2000+1000)/1000 * 1.322 = 14.542

Output:

[Project1] 25052 1556535358.143966902, 1556535359.457462115
[Project1] 25051 1556535356.832772279, 1556535362.097956658
[Project1] 25054 1556535363.421468131, 1556535366.072364595
[Project1] 25055 1556535366.073196344, 1556535367.400816985
[Project1] 25053 1556535362.098579119, 1556535371.356740556

P1 25051 -1556535358.143966902+1556535359.457462115 = 1.313

P2 25052 -1556535356.832772279+1556535362.097956658 = 5.265

P3 25053 -1556535363.421468131+1556535366.072364595 = 2.651

P4 25054 -1556535366.073196344+1556535367.400816985 = 1.328

P5 25055 -1556535362.098579119+1556535371.356740556 = 9.258

實際總時間: $\cong -1556535356.832772279 + 1556535371.356740556 = 14.524$

誤差值： $((14.542/14.524)-1)*100\% = 0.124\%$

PSJF_2

PSJF

4

P1 0 7000

P2 0 2000

P3 100 1000

P4 200 4000

理論總時間：(7000+2000+1000+4000)/1000 * 1.322 = 18.508

Output:

[Project1] 25065 1556535376.137871075, 1556535377.466204378
[Project1] 25064 1556535375.999773469, 1556535379.971203478
[Project1] 25066 1556535379.971881565, 1556535385.239398932
[Project1] 25067 1556535385.240031084, 1556535394.430101083

P1 25067 -1556535376.137871075+1556535377.466204378 = 1.328

P2 25064 -1556535375.999773469+1556535379.971203478 = 3.971

P3 25065 -1556535379.971881565+1556535385.239398932 = 5.268

P4 25066 -1556535385.240031084+1556535394.430101083 = 9.190

實際總時間: $\cong -1556535375.999773469 + 1556535394.430101083 = 18.430$

誤差值：((18.508/18.430)-1)*100% = 0.423%

RR:

RR_1:

RR

2

P1 600 4000

P2 800 5000

理論總時間：(4000+5000)/1000 * 1.322 = 11.898

Output:

[Project1] 1603 1556625699.496922319, 1556625709.410786809

[Project1] 1604 1556625700.165853772, 1556625711.414778582

P1 1603 -1556625699.496922319+1556625709.410786809 = 9.914

P2 1604 -1556625700.165853772+1556625711.414778582 = 11.249

實際總時間：≅ -1556625699.496922319 + 1556625711.414778582 = 11.917

誤差值：((11.917/11.898)-1)*100% = 0.160%

RR_2:

RR

7

P1 0 8000

P2 200 5000

P3 200 3000

P4 400 1000

P5 400 1000

P6 600 1000

P7 600 4000

理論總時間：(8000+5000+3000+1000+1000+1000+4000)/1000 * 1.322 = 30.406

Output:

[Project1] 1627 1556625754.449413145, 1556625759.805274764

[Project1] 1628 1556625755.123574673, 1556625760.463588947

[Project1] 1629 1556625755.792822560, 1556625761.127453468

[Project1] 1626 1556625753.788405148, 1556625771.677209312

[Project1] 1630 1556625757.126342205, 1556625776.954053248

[Project1] 1625 1556625753.128148729, 1556625778.927302051

[Project1] 1624 1556625752.450384091, 1556625782.908854127

P1 1624 -1556625754.449413145+1556625759.805274764 = 5.356

P2 1625 -1556625755.123574673+1556625760.463588947 = 5.340

P3 1626 -1556625755.792822560+1556625761.127453468 = 5.335

P4 1627 -1556625753.788405148+1556625771.677209312 = 17.889

P5 1628 -1556625757.126342205+1556625776.954053248 = 19.828

P6 1629 -1556625753.128148729+1556625778.927302051 = 25.799

P7 1630 -1556625752.450384091+1556625782.908854127 = 30.458

實際總時間: $\cong -1556625752.450384091+1556625782.908854127 = 30.458$

誤差值: $((30.458/30.406)-1)*100\% = 0.171\%$

3. 實際結果與理論結果的比較：

誤差值：

	_1	_2
FIFO	2.179%	1.105%
SJF	0.043%	2.413%
PSJF	0.124%	0.423%
RR	0.160.%	0.171%

造成誤差的原因：

我們是以單核來跑這次的 project，造成實際值與理論值會有誤差可能是因 context switch 的關係；加上還有其他程式也同時在進行，會吃掉 CPU 的效能。

4. 各組員貢獻：

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