2020 OS Project 1 Report

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1. 設計

   從 test_inputs 讀取各組測資，依照 FIFO, RR, SJF, PSJF 四種 process scheduling policy 呼叫對應的 scheduler 進行排程。
   各個行程間依照 ready time 用qsort() 排序，parent process 創造出 pipe，接著 fork() 產生 child process，並關上 parent 的 read 與 child 的 write，使得 parent 與 child 間能進行溝通，溝通的目的為當輪到某行程執行時，parent 呼叫函數 assign_core 指定 child 到對應的 CPU core 上執行。
   除了利用 read, write，同時也藉由降低與提升 child 的 priority group 來幫助排程。
   最後在 kernel_files 新增系統呼叫，在 dmesg 紀錄每個行程的 pid 與開始和結束的時間。

2. 核心版本

   Linux 4.14.25 with VM (Virtualbox) on Mac OS Catalina 10.15.4

3. 實際結果與理論結果

TIME_MEASUREMENT :

process	pid	turnaround time (sec)
P0	2077	1.23349785804749
P1	2078	1.16650915145874
P2	2079	1.15336942672730
P3	2080	1.15318512916565
P4	2084	1.18059682846069
P5	2085	1.17261052131653
P6	2086	1.13735842704773
P7	2087	1.13877940177917
P8	2088	1.13641524314880
P9	2089	1.13659524917603

Average turnaround time (500 time units) : 1.1608917236328125 sec
Time unit : 0.002321783447265625 sec

All time below are measured in time units :

FIFO_1:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2096	0	500	500	513.549866621013	2.7099733242026
P2	2097	0	500	1000	1028.54370700261	2.854370700261
P3	2098	0	500	1500	1505.93567708813	0.395711805875333
P4	2099	0	500	2000	2074.47601347	3.7238006735
P5	2100	0	500	2500	2644.00913443971	5.7603653775884

FIFO_2:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2155	0	80000	80000	89459.9102944984	11.824887868123
P2	2223	100	5000	85000	85082.1679170468	0.0966681377021176
P3	2225	200	1000	86000	86109.4272269592	0.127240961580465
P4	2226	300	1000	87000	87003.4351496842	0.00394844791287356

FIFO_3:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2264	0	8000	8000	7966.06173896099	-0.424228262987625
P2	2265	200	5000	13000	13167.4474764788	1.28805751137538
P3	2267	300	3000	16000	16262.7793598072	1.642370998795
P4	2268	400	1000	17000	17090.6252135904	0.533089491708235
P5	2269	500	1000	18000	18052.9278437425	0.294043576347222
P6	2270	500	1000	19000	18983.2366864178	-0.0882279662221053
P7	2271	600	4000	23000	23111.2732641016	0.483796800441739

FIFO_4:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2281	0	2000	2000	2000.70195251195	0.0350976255975
P2	2282	500	500	2500	2495.51965393098	-0.1792138427608
P3	2283	500	200	2700	2699.42154791917	-0.0214241511418519
P4	2284	1500	500	3200	3195.81447028925	-0.130797803460938

FIFO_5:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2296	0	8000	8000	8452.1299152079	5.65162394009875
P2	2297	200	5000	13000	13023.3247899914	0.179421461472308
P3	2299	200	3000	16000	15948.7960361237	-0.320024774226875
P4	2300	400	1000	17000	17041.3916005741	0.243480003377059
P5	2301	400	1000	18000	18109.1729722385	0.606516512436111
P6	2302	600	1000	19000	19044.8126409697	0.235856005103684
P7	2303	600	4000	23000	23222.9166557133	0.969202850927391

RR_1:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2317	0	500	500	523.944325363235	4.788865072647
P2	2318	0	500	1000	996.222859232757	-0.3777140767243
P3	2319	0	500	1500	1496.47988652107	-0.234674231928667
P4	2320	0	500	2000	1996.18188684441	-0.1909056577795
P5	2321	0	500	2500	2495.91284509636	-0.1634861961456

RR_2:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2331	600	4000	8100	8079.91818994955	-0.247923580869753
P2	2332	800	5000	9600	9568.01508473952	-0.33317620063

RR_3:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2340	1200	5000	20200	20496.2567174179	1.4666174129599
P2	2341	2400	4000	20700	20987.3915453692	1.3883649534744
P3	2342	3600	3000	18200	18408.5981922695	1.14614391356868
P4	2345	4800	7000	31200	31554.8642172996	1.13738531185769
P5	2346	5200	6000	30200	30583.3704638329	1.26943862196325
P6	2347	5800	5000	28200	28613.7174488237	1.46708315185709

RR_4:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2361	0	8000	23000	24631.4075680992	7.09307638304
P2	2362	200	5000	20000	20898.7389705206	4.493694852603
P3	2363	300	3000	14500	14528.5713505288	0.197043796750345
P4	2364	400	1000	5500	5560.54102693605	1.10074594429182
P5	2365	500	1000	6000	6052.97397105291	0.8828995175485
P6	2366	500	1000	6500	6542.43872748757	0.652903499808769
P7	2367	600	4000	18000	18345.3296652743	1.91849814041278

RR_5:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2401	0	8000	23000	23039.0127170078	0.169620508729565
P2	2402	200	5000	20000	20032.6367972547	0.1631839862735
P3	2403	200	3000	14500	14388.1712981827	-0.771232426326207
P4	2404	400	1000	5500	5488.24365603666	-0.213751708424364
P5	2405	400	1000	6000	5997.96633191027	-0.0338944681621667
P6	2406	600	1000	6500	6491.53397500269	-0.130246538420154
P7	2407	600	4000	18000	18048.2255279626	0.267919599792222

SJF_1:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2425	0	7000	14000	14114.8513345128	0.820366675091429
P2	2419	0	2000	2000	2119.43870169242	5.971935084621
P3	2420	100	1000	3000	2995.86973680406	-0.137675439864667
P4	2421	200	4000	7000	6986.65743928775	-0.190608010175

SJF_2:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2434	100	100	200	198.994116570409	-0.5029417147955
P2	2436	100	4000	4400	4521.80419478393	2.76827715418023
P3	2435	200	200	400	402.882841889217	0.72071047230425
P4	2439	200	4000	8400	8395.38260693978	-0.054968965002619
P5	2440	200	7000	15400	15314.018446981	-0.558321772850649

SJF_3:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2451	100	3000	3100	3124.61046040888	0.79388581964129
P2	2456	100	5000	16120	16032.2062351637	-0.54462633273139
P3	2457	100	7000	23120	23010.7790931478	-0.472408766661765
P4	2452	200	10	3110	3110.04809316353	0.00154640397202572
P5	2453	200	10	3120	3119.85812093685	-0.00454740587019231
P6	2454	300	4000	7120	7100.25321880726	-0.277342432482303
P7	2455	400	4000	11120	11047.6213620627	-0.650887031810252
P8	2460	500	9000	32120	35222.8059657769	9.6600434800028

SJF_4:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2468	0	3000	3000	3489.60414470519	16.3201381568397
P2	2469	1000	1000	4000	4068.70724495335	1.71768112383375
P3	2470	2000	4000	8000	8559.05392434562	6.98817405432025
P4	2474	5000	2000	11000	10972.3638468025	-0.251237756340909
P5	2473	7000	1000	9000	9052.82772324468	0.586974702718667

SJF_5:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2480	0	2000	2000	2156.91755213577	7.8458776067885
P2	2481	500	500	2500	2548.39867994564	1.9359471978256
P3	2482	1000	500	3000	3000.85376599299	0.028458866433
P4	2483	1500	500	3500	3498.08951606331	-0.054585255334

PSJF_1:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2495	0	10000	25000	24836.056330195	-0.65577467922
P2	2496	1000	7000	16000	15896.5876428755	-0.646327232028125
P3	2497	2000	5000	10000	9979.05409357494	-0.2094590642506
P4	2498	3000	3000	6000	6037.69051031017	0.628175171836167

PSJF_2:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2508	0	3000	4000	4580.74372093528	14.518593023382
P2	2509	1000	1000	2000	2149.78749398661	7.4893746993305
P3	2510	2000	4000	11000	11102.4317718342	0.931197925765455
P4	2511	5000	2000	7000	7029.4190784856	0.420272549794286
P5	2512	7000	1000	8000	7988.17165142836	-0.1478543571455

PSJF_3:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2521	0	2000	3500	3567.6720503495	1.93348715284286
P2	2522	500	500	1000	1015.54241855963	1.554241855963
P3	2523	1000	500	1500	1500.07693361742	0.005128907828
P4	2524	1500	500	2000	1998.94305614339	-0.0528471928305

PSJF_4:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2538	0	7000	14000	14168.0783691092	1.20055977935143
P2	2535	0	2000	3000	3227.42234510425	7.58074483680833
P3	2536	100	1000	1100	1167.17062635876	6.10642057806909
P4	2537	200	4000	7000	7506.40419994296	7.23434571347086

PSJF_5:

process	pid	ready time	execution time	expected end time	end time	error (%)
P1	2548	100	100	200	198.346670684357	-0.8266646578215
P2	2550	100	4000	4400	5684.70367454344	29.1978107850782
P3	2549	200	200	400	635.242390595713	58.8105976489283
P4	2551	200	4000	8400	8696.61797271169	3.53116634180583
P5	2552	200	7000	15400	15760.850786407	2.34318692472078

4. 產生差異的原因

因為在 VM 上執行，除了 VM 本身的誤差外，電腦本身的作業系統也正在執行其他程式，使得 CPU 本身的利用不是完全用來跑測試。另外，因為所有時間都是以 time unit 作為單位，跑 TIME_MEASUREMENT 時的誤差也會影響到其他所有的測資。最後是程式中的誤差，在使用 pipe 時，有使用 I/O request，因此也會使得時間上的測量有所差異。