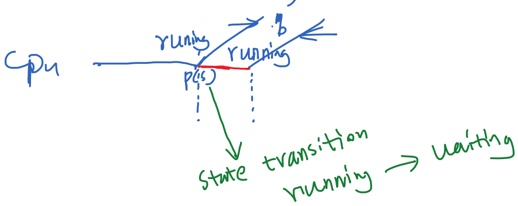
Tuesday, October 23, 2018 1:05 PM

Two implementation of P / V

1° busy waiting

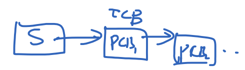
```
P( s ) {
    while( s <= 0 )
        ;     // loop
    s--
}
```

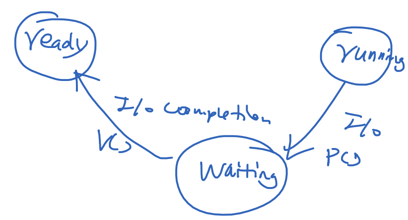


2° non-busy waiting

```
P( s ) {
    s--;
    if( s < 0 )
        block()
}
```

Sem





Compare

Cost of state transition c

with

busy waiting time. b

```
V(S) {
    S++;
    if( s <= 0 )
        wakeup()
}
```

Scheduler pick P4 → P3

R = 1.

→ P(R) R: 1 → 0
R: 0 → −1 P4 is blocked
→ print 'E'; ✓
→ V(T) : T: 0 → 1
→

P4 is ready

→ P(T) T: 1 → 0
T: 0 → −1 P3 is blocked
print 'D'
V(R) R → −1 → 0
wakeup

P2
P(T) T: −1 → −2
P2 is blocked

P1, P4 are in ready Queue
✓ P1
→ P(s) s: 3 → 2
print ('A');

c

1 second task P1
1 second task P2 time slice q_e = 10ms

$\boxed{200 \cdot C}$

$P_1 : \frac{1s + 100 \cdot C}{1s + 100 \cdot C}$ $1.1s$ C is 1ms (10%)

$P_2 : 1s + 100 \cdot C$

2GB file on HD.

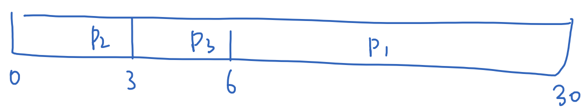
1° load 2GB file into mem

2° processing + analysis

minimized partial loading

F.C.F.S. w/ a different order from the slide 7.

P_2, P_3, P_1



Waiting time : $P_1 : 6$ Avg-W : $3 \leftarrow 17$

$P_2 : 0$

$P_3 : 3$

Completion time : $P_1 : 30$ Avg-C : $13 \leftarrow 27$

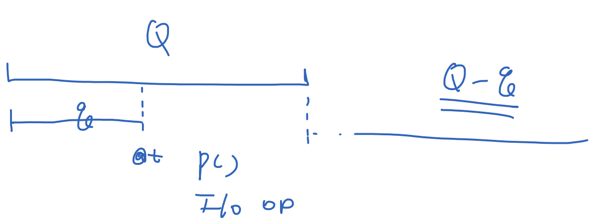
$P_2 : 3$

$P_3 : 6$

Assume a set of processes $P_1, P_2, \dots P_n$ ordered by cpu time ascendingly. $C_1 < C_2 < \dots < C_n$

$P_1 \to P_2 \to P_3 \to \dots \to P_n$ is the optimal FCFS scheduling

$P_n \to P_{n-1} \to \dots \to P_2 \to P_1$ is the worst FCFS scheduling



$$\frac{q_e}{n \cdot q_e} = \frac{1}{n}$$

each execution time will be bounded @ q_e

1° process terminates (completes) its execution during the time quantum

2° process issues I/O op or P( ) " "

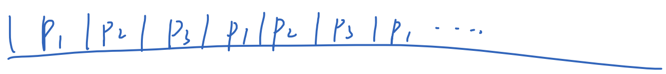
Waiting time : $(n-1) \cdot q_e$ ✓

R.R. Scheduling, it's a hyper-parameter q_e time quantum

if $q_e \geqslant \max_{\forall i} C_i$ C_i is the cpu burst of process P_i

RR $\longrightarrow$ FCFS

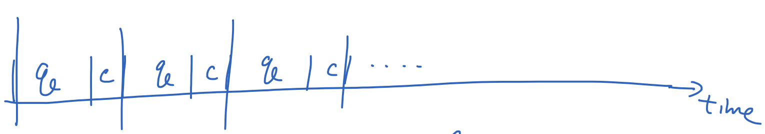
if q_e is small, interleaved processes



if q_e is really small, context switch impact will be accumulated.

C : Cost of context switch.

q_e : time quantum



cpu utilization $\mathcal{U} = \dfrac{q_e}{q_e + c}$

if $q_e = c$ $\mathcal{U} = \dfrac{q_e}{q_e + q_e} = 50\%$

if $q = 10 \cdot c$ $\quad U = \dfrac{10 \cdot c}{10 \cdot c + c} = \dfrac{10}{11} \doteq 90\%$

if $q = 100 \cdot c$ $\quad U = \dfrac{100 \cdot c}{100 \cdot c + c} = \dfrac{100}{101} \doteq 99\%$

Response time:

$J_1 : 0$

$J_2 = 100$

$J_3 = 200$

$\vdots$

$J_{10} = 900$

$\dfrac{900 \cdot 10}{2 \cdot 10} = 450$

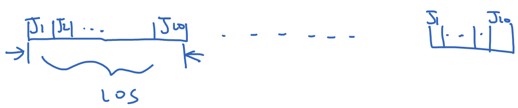
$(1+2+3+\dots+9) \times 100$

$= \dfrac{(1+9) \cdot 9}{2} \times 100 = 4500$

$\dfrac{4500}{10} = \text{Avg-R} = 450$

each os $\quad (n-1) \cdot q = 9 \cdot \times 1 = \boxed{9}$

$99 \times 9 = 891$



"SJF"