

Homework-1

Ques 1) Let us assume that there is a task which includes  $n$  processes.

TASK:- Analytically prove the optimality of the SJF scheduling.

Sol<sup>n</sup>:- SJF scheduling associates with each process the length of the process, the length of the process's next CPU burst. If the next CPU burst of 2 processes are same, "first come first serve" is used to break the tie.

→ Avg. waiting time for  $n$  processes:-

$$w_T = \frac{(w_1 + w_2 + \dots + w_n)}{n} \quad \text{--- (i)}$$

where  $w_T$  :- total waiting time

$$\Rightarrow w_i = w_{i-1} + t_{i-1} \quad \forall i \in [1, n] \quad \text{--- (ii)}$$

where  $t_{i-1}$  :- burst time of  $(i-1)^{th}$  process.

Consider  $w_0 = 0$  &  $t_0 = 0$

using (i) & (ii) :-

$$w_1 = w_0 + t_0$$

$$w_2 = w_1 + t_1 = w_0 + t_0 + t_1$$

$$w_3 = w_2 + t_2 = w_0 + t_0 + t_1 + t_2$$

⋮

$$w_n = w_{n-1} + t_{n-1} = w_0 + \sum_{i=0}^{n-1} t_i$$

$$\Rightarrow w_T = \frac{n \times w_0 + n t_0 + (n-1)t_1 + (n-2)t_2 + \dots + t_{n-1}}{n}$$

$$w_T = \frac{(n-1)t_1 + (n-2)t_2 + \dots + t_{n-1}}{n} \quad \text{--- (iii)}$$

taking 2 random processes  $i$  &  $j$  where  
 $t_i > t_j$  or  $j > i$

swapping them, we get new avg. waiting time  
 as:

$$w'_T = \frac{(n-1)t_1 + \dots + (n-i)t_j + \dots + (n-j)t_i + \dots + t_{n-1}}{n}$$

$\hookrightarrow$  (iv)

subtracting (iii) & (iv)

$$w_T - w'_T = \frac{(j-i)(t_i - t_j)}{n}$$

now,  $\because j > i$  &  $t_i > t_j$

$$\therefore w_T - w'_T > 0$$

$$\therefore \boxed{w_T > w'_T}$$

similarly, we can keep swapping until they  
 are in increasing order.



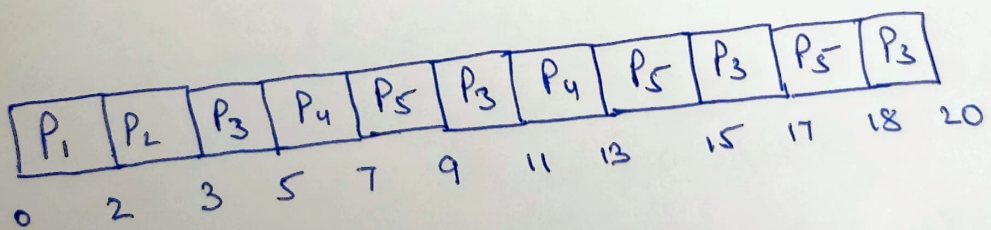
Hence proved

Drawbacks :- It can't be implemented at CPU scheduling level, as there is no way to know the length of next CPU burst. We can approximate it at best & that too only to a certain degree.

Ques 2)

Process id	Burst time (msec)	Arrival time
P <sub>1</sub>	2	0
P <sub>2</sub>	1	0
P <sub>3</sub>	8	0
P <sub>4</sub>	4	0
P <sub>5</sub>	5	0

Gantt chart :-



$$\text{average response time} = \frac{0 + 2 + 3 + 5 + 7}{5} = \frac{17}{5} = \underline{\underline{3.4 \text{ msec}}}$$

$$\text{waiting time} = \text{turnaround time} - \text{burst time}$$

$$\text{average burst time} = \frac{2+1+8+4+5}{5} = \frac{20}{5} = \underline{\underline{4\text{msec}}}$$

$$\begin{aligned}\text{average waiting} &= (11.2 - 4) \text{ msec} \\ \text{time} &= \underline{\underline{7.2 \text{ msec}}}\end{aligned}$$