

HW5: Performance analysis I

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Consider the process in figure 4.46.

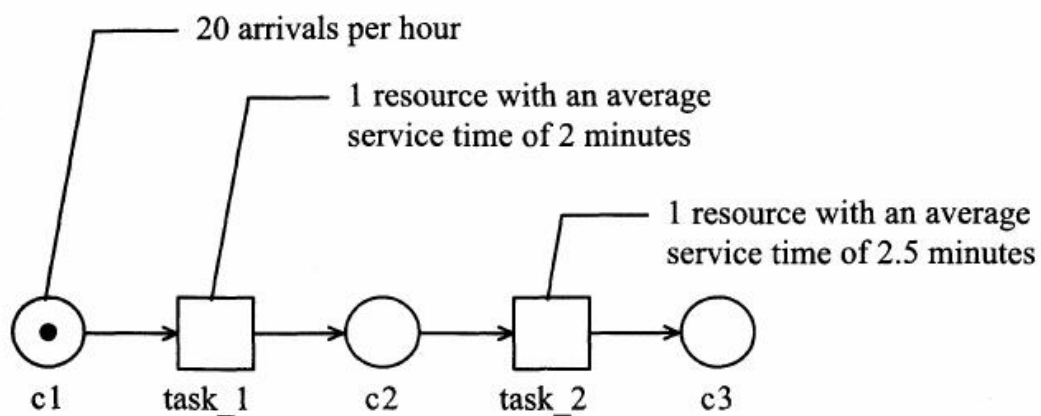


Figure 4.46
Process (1)

(a) Determine the following performance indicators:

- Occupation rate (utilization) for each resource,

Task_1:

每小时到达任务: $\lambda = 20$

每小时处理任务: $\mu = 60/2 = 30$

资源占有率: $\rho = 20/30 = 0.667$

Task_2:

每小时到达任务: $\lambda = 20$

每小时处理任务: $\mu = 60/2.5 = 24$

资源占有率: $\rho = 20/24 = 0.833$

- Average WIP (work in progress),

Task_1: $L1 = \rho \text{ task1} / (1 - \rho \text{ task1}) = 2$

Task_2: $L2 = \rho \text{ task2} / (1 - \rho \text{ task2}) = 5$

$L1 + L2 = 7$

- **Average flow time (throughput time), and**

Task_1: $S1 = 2/30 \cdot 60 + 2 = 6\text{min}$

Task_2: $S2 = 5/24 \cdot 60 + 2.5 = 15\text{min}$

$S1 + S2 = 21\text{min}$

- **Average waiting time for each task.**

Task_1: $w = 2/3/10 \cdot 60 = 4\text{min}$

Task_2: $w = 5/6/4 \cdot 60 = 12.5\text{min}$

Task 2 is a check task. The management thinks about a selective execution of this task where only 25% of the cases are checked. The average service time of this new task is 6 minutes.

(b) Determine the performance indicators again:

- **Occupation rate (utilization) for each resource,**

Task_1:

每小时到达任务: $\lambda = 20$

每小时处理任务: $\mu = 60/2 = 30$

资源占有率: $\rho = 20/30 = 0.667$

Task_2:

每小时到达任务: $\lambda = 20$

每小时处理任务: $\mu = 60/6 = 10$

资源占有率: $\rho = 10/20 = 0.5$

- **Average WIP (work in progress),**

Task_1: $L1 = \rho_{\text{task1}} / (1 - \rho_{\text{task1}}) = 2$

Task_2: $L2 = \rho_{\text{task2}} / (1 - \rho_{\text{task2}}) = 1$

$L1 + L2 = 3$

- **Average flow time (throughput time), and**

Task_1: $S1 = 2/30 \cdot 60 + 2 = 6\text{min}$

Task_2: $S2 = 1/5 \cdot 60 = 12\text{min}$

$S1 + S2 = 18\text{min}$

- **Average waiting time for each task.**

Task_1: $w = 2/3/10 \cdot 60 = 4\text{min}$

Task_2: $w = 1/2/5 \cdot 60 = 6\text{min}$