Homework 5

16340305 郑先淇

题目
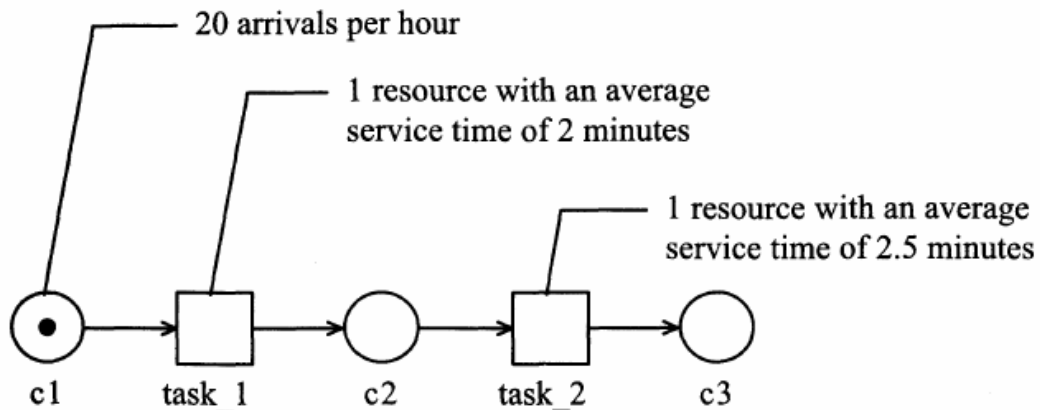
Consider the process in figure 4.46.

Figure 4.46
Process (1)

(a) Determine the following performance indicators:
• Occupation rate (utilization) for each resource,
• Average WIP (work in progress),
• Average flow time (throughput time), and
• Average waiting time for each task.
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,
• Average WIP (work in progress),
• Average flow time (throughput time), and
• Average waiting time for each task.

解答

(a)

　　由上图可看出，有两个任务，task_1 和 task_2。

　　对于 task_1，有 λ = 20(以小时为单位)，μ = 60/2 = 30（以小时为单位），则有

　　Utilization a = λ / μ = 0.67

　　Average WIP L = a/(1-a) = 2

　　Average waiting time = L/μ = 2/30 = 1/15（4 分钟）

```
Average flow time = waiting time + processing time
                  = W + 1/μ = 1/15 + 1/30 = 1/10（6 分钟）
```

对于 task_2,由于通过 task_1 的任务每小时最多 20 个,所以 task_2 的 λ 也是 20，μ = 60/2.5 = 24(以小时为单位)，则有

```
Utilization a = λ/μ = 0.83
Average WIP L = a/(1-a) = 5
Average waiting time = L/μ = 5/24（12.5 分钟）
Average flow time = waiting time + processing time
                  = W + 1/μ = 5/24 + 1/24 = 1/4（15 分钟）
```

(b)

对于 task_1 来说其条件没有变化，所以仍有

```
Utilization a = λ/μ = 0.67
Average WIP L = a/(1-a) = 2
Average waiting time = L/μ = 2/30 = 1/15（4 分钟）
Average flow time = waiting time + processing time
                  = W + 1/μ = 1/15 + 1/30 = 1/10（6 分钟）
```

对于 task_2,由于现在该任务变成可选任务，到达的任务中只有 25%需要被检查，则有 λ = 20*25% = 5；因为处理时间变为 6 分钟，则有 μ = 60/6 = 10(以小时为单位),则有

```
Utilization a = λ/μ = 0.5
Average WIP L = a/(1-a) = 1
Average waiting time = L/μ = 1/10（6 分钟）
Average flow time = waiting time + processing time
                  = W + 1/μ = 1/10 + 1/10 = 1/5（12 分钟）
```