Module 4 – Practice Solutions

Concierge

C1.
Use the waiting time formula for one resource:
Activity time = 4 min
Utilization = flow rate/capacity = (12 guests/hr) / (15 guests/hr) = 0.8
CVa = std dev (inter-arrival times) / avg(inter-arrival times) = 1
CVp = std dev(processing times) / avg(processing times) = 0.75
Therefore, average waiting time = 4 * (0.8 / (1-0.8)) * ((1^2 + 0.75^2)/2) = 12.5 minutes

C2.
Use Little's Law (inventory = flow rate x flow time):
Flow rate = 12 guests/hr
Flow time = waiting time + processing time = 12.5 min + 4 min = 16.5 min = 0.275 hr
Therefore inventory = (12 guests/hr) * 0.275 hr = 3.3 guests

Music Venue

MV1.

$$\text{utilization} = \frac{\text{activity time}}{\text{interarrival time} \times \text{number of servers}}$$
$$= \frac{4}{10 \times 0.5} = 0.8$$

MV2.

$$T_q = \frac{\text{activity time}}{\#\text{ of servers}} \times \frac{\text{utilization}^{\sqrt{2\times(\#\text{ of servers}+1)}-1}}{1-\text{utilization}} \times \left(\frac{CVa^2 + CVp^2}{2}\right)$$
$$= \frac{4}{10} \times \frac{0.8^{\sqrt{2(10+1)}-1}}{1-0.8} \times \left(\frac{(0.5)\text{^}2 + (.25)\text{^}2}{2}\right)$$
$$= 0.137 \text{ minutes}$$

MV3.
5*(1-0.8)=1 hour

MV4.
0.137*2= 0.274

MV5.

We should redo the computations of 1 and 2.
For n=9, the wait time is 0.415
And for n=8, the system is unstable since utilization=1, so the answer is 9.

TechCall

TC1.
r = p/a = 20/5 = 4
m = 5
The probability that the 5 technicians overseas are busy = 0.1991
Thus, the probability that the answer is handled in the U.S. = 0.1991

TC2.
r = p/a = 20/5 = 4
m = 10
From Erlang loss table, probability that the 10 technicians overseas are busy = 0.0053
Thus, the probability that the answer is handled in the U.S. = 0.0053

TC3.
Revenue per hour is the same (customers pay the same). Hence, additional revenue = 0.

TC4.
Additional profit = (0.1991-0.0053) * (1/(5/60)) * $25 = $58.14

Computer Priority

CP1.
ANSWER: Use shortest processing time to evaluate. Hence, the jobs will be sequenced D, A, E, C, B. Wait times are D = 0, A = 2, E = 2 + 5, C = 2 + 5 + 15, B = 2 + 5 + 15 + 50. Total time is 2 + 7 + 22 + 72 = 103 milliseconds. This is the minimum because it will only be longer if additional jobs arrive.