

MODEL-II (M/M/1):(N/FCFS) Numerical-03

Q: If for a period of 2 hours in the day (8-10)am trains arrive at the yard every 20 min but the service time continues to remain 36 minutes, then calculate for this period

- (a) the probability that the yard is empty, and  
 (b) the average no. of train in the system, on the assumption that the line capacity of the yard is limited to 4 trains only.

Solution:  $\lambda = \frac{1}{20}$  per min,  $N = 4$

$\mu = \frac{1}{36}$  per min

$\rho = \frac{\lambda}{\mu} = \frac{\frac{1}{20}}{\frac{1}{36}} = \frac{36}{20} = 1.8$

$$(i) P_0 = \frac{1 - \rho}{1 - \rho^{N+1}}$$

$$= \frac{1 - 1.8}{1 - (1.8)^5} = \frac{-0.8}{-17.8956} = 0.04$$

(ii) Average no. of train in the system,

$$L_s = P_0 \sum_{n=0}^N n \rho^n \quad (N=4)$$

$$= 0.04 [0 + \rho + 2\rho^2 + 3\rho^3 + 4\rho^4]$$

$$= (0.04) (0 + 1.8 + 6.48 + 17.496 + 41.9904)$$

$$= (0.04) (67.7664)$$

$$= 2.71 = 3 \text{ (approx)}$$

$$L_s = 3 \text{ train.}$$