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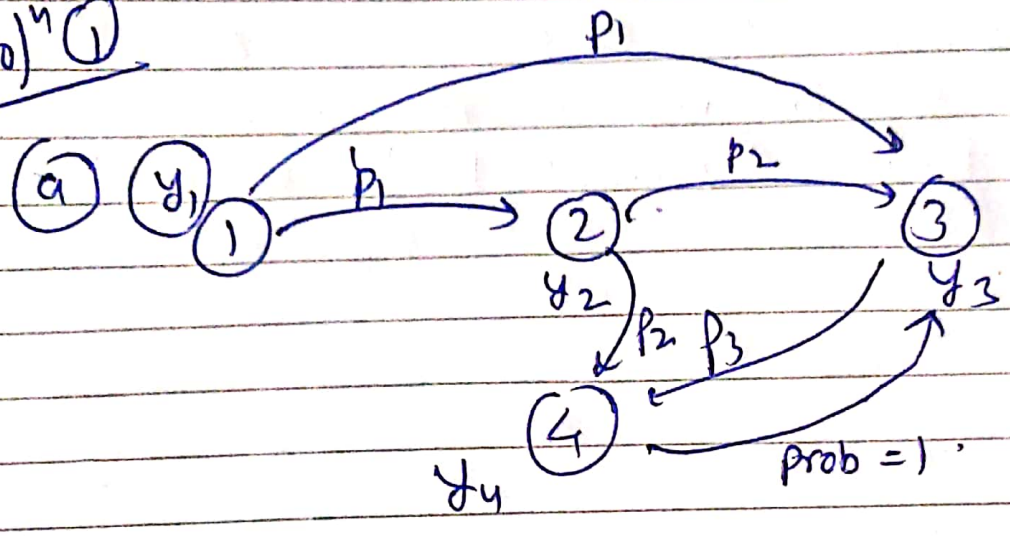
Soln ①



(b) on solving we get

$p_1 = 1/3$

$p_2 = 1/2 \quad p_3 = 1/2$

Let λ_i be the aggregate arrival rate at node i

Using the equations:

$$\lambda = \gamma (I - R)^{-1} \qquad R = \begin{pmatrix} 0 & 1/3 & 1/3 & 0 \\ 0 & 0 & 1/2 & 1/2 \\ 0 & 0 & 0 & 1/2 \\ 0 & 0 & 1 & 0 \end{pmatrix}$$

$$\text{So } (I-R)^{-1} \Rightarrow \begin{pmatrix} 1 & 1/3 & 4/3 & 5/6 \\ 0 & 1 & 2 & 3/2 \\ 0 & 0 & 2 & 1 \\ 0 & 0 & 2 & 2 \end{pmatrix}$$

180123029

$$\lambda = (5 \;\; 0 \;\; 15 \;\; 0) \begin{pmatrix} 1 & 1/3 & 4/3 & 5/6 \\ 0 & 1 & 2 & 3/2 \\ 0 & 0 & 2 & 1 \\ 0 & 0 & 2 & 2 \end{pmatrix}$$

$$\lambda = (5, 35/3, 170/3, 205/6)$$

$\lambda_i \rightarrow$ λ's at station 1, 2, 3, 4.

(c) Now, L_i for each node is as follows:-

$$L_i = \frac{\lambda_i}{\mu_i - \lambda_i} \Rightarrow \text{using this formula:}$$

$$L_1 = \frac{5}{10-5} = 1, \quad L_2 = \frac{35/3}{35-35/3} = \frac{1}{2}.$$

$$L_3 = \frac{170/3}{85-170/3} = 2, \quad L_4 = \frac{205/6}{41-205/6} = 5.$$

Hence, $\boxed{L_1 = 1,\ L_2 = 1/2,\ L_3 = 2,\ L_4 = 5}$

Hence, ans.

(d) Total $L = L_1 + L_2 + L_3 + L_4 = 5 + 2 + 1/2 + 1 = 17/2$.

~~$L = \sum(\lambda_1 + \lambda_2 + \lambda_3 + \lambda_4) W$.~~

~~$W = \frac{17/2}{5 + 35/3 + 170/3 + 205/6} = \frac{17 \times 3}{645} = 0.079069$~~

$$\hookrightarrow W = \frac{\sum L_i}{\sum \gamma_i} = \frac{17/2}{5+10+15+10} = 0.2833.$$

$\gamma_i \rightarrow$ rates of poisson processes

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(e) When we consider the aggregate process at node 2, it can not be considered as a poisson process. Because feed forward and by passing occurs here.