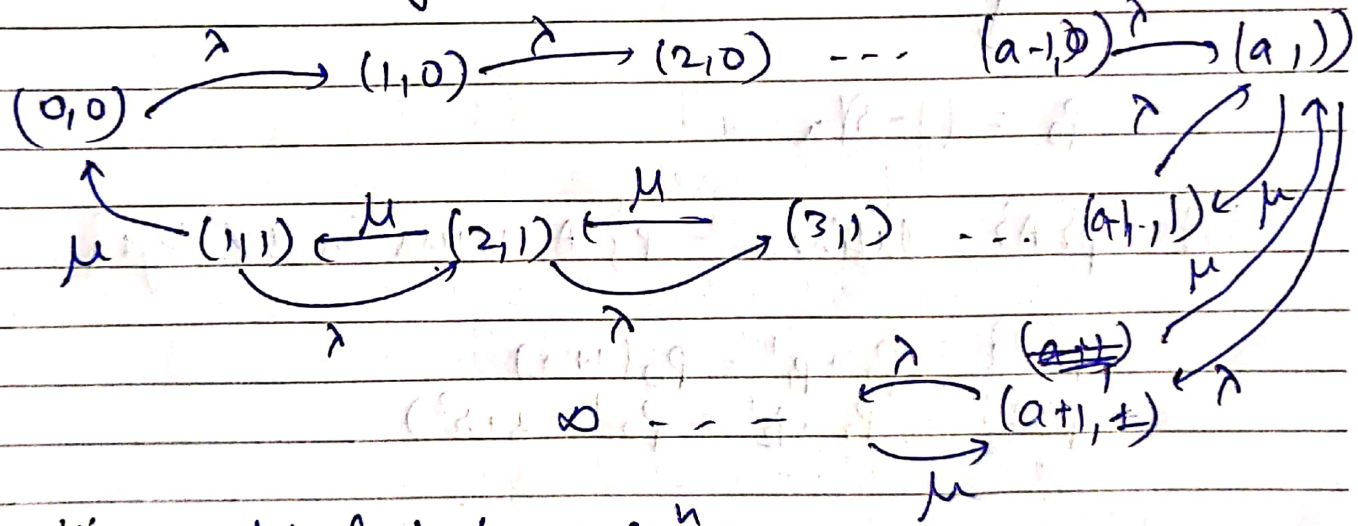
Sol^n (2) Consider the states as ~~tg~~ tuple.
(No. of customers, flag)

flag defines if a state A is reached atleast once after reaching state 0.
0 → implies customers is reached before but a customer are not yet completed.
1 → implies a customer is completed and we haven't got 0 customer yet.

Transition diag.



Writing global balance eq^n.

$$I p_0 = I p_1 = I p_2' = \dots = I p'_{(a-1)}$$

$$I p_0 = m p_1$$

$$\cancel{(I+m) I p_1}, \quad (I+m) p_1 = m p_2$$

$$(I+m) p_{a-1} = I p_1 + I p_2 \dots + m p_a$$

$$\Downarrow$$

$$p_{k+1} m = I p_k \qquad k = a, \dots \infty$$

These can be solved as:

$$P_{a-1} = P_{a-2} \cdots = P_0.$$

$$P_1 = r P_0$$
$$P_2 = r(1+r)P_0.$$
$$\vdots$$
$$P_a = r(1+r \cdots + r^{a-1}) P_0.$$
$$\Downarrow$$
$$P_n = r^{n-a} P_a \quad n \in \{a+1, \cdots\}.$$
$$\Downarrow$$
$$P_0 = (1-r)/a.$$

Let $p\{A\}$ defines $= p\{A$ users in the sys$\}$.

$$p\{1\} = P_1 + P_1' = P_0(1+r)$$
$$p\{2\} = P_2 + P_2' = P_0(1+r+r^2)$$
$$\vdots$$
$$p\{a\} = P_a = P_0(1+r+\cdots+r^{a-1})r.$$
$$\Downarrow$$
$$p\{n\} = P_0(1+r+\cdots+r^{a-1})r^{n-a+1}.$$
$$n = a-1, a, \cdots \infty.$$

The Server will be ~~idde~~ idle in the states $0, 1', 2', \dots (a-1)'$.

$$P_{idle} = P_0 + P_1' + P_2' \dots + P_{a-1}' = aP_0 = 1-\lambda .$$

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