



# LAMPIRAN

**LAMPIRAN 1**

Tabel 2.1  
Data jumlah konsumen creambath rambut yang dilayani dan  
rata-rata pelayanan creambath rambut  
selama bulan Maret 2003

Tanggal	Jumlah konsumen yang dilayani	Jam kerja	Rata-rata pelayanan
1	22	8	1,45
2	22	8	1,45
4	14	8	2,29
5	16	8	2
6	15	8	2,13
7	13	8	2,46
8	26	8	1,39
9	24	8	1,6
11	14	8	2,29
12	16	8	2
13	16	8	2
14	22	8	1,45
15	15	8	2,13
16	22	8	1,45
18	16	8	2
19	14	8	2,29
20	16	8	2
21	17	8	1,88
22	14	8	2,29
23	21	8	1,52
25	13	8	2,46
26	14	8	2,29
27	14	8	2
28	14	8	2
29	18	8	1,77
30	17	8	1,88
jumlah	440		

Sumber : data sekunder yang diolah

## LAMPIRAN 2

### Perhitungan 5 fasilitas

- Menghitung tingkat kegunaan fasilitas pelayanan

$$\begin{aligned} P &= \frac{\lambda}{s \mu} \\ &= \frac{2,16}{5(0,5725)} \\ &= 0,7546 \end{aligned}$$

- Menghitung probabilitas tidak ada individu dalam sistem

$$\begin{aligned} P_0 &= \frac{1}{\sum_{n=0}^{s-1} \left[ \frac{(\lambda \mu)^n}{n!} \right] + \frac{(\lambda \mu)^s}{s!(1-\lambda/\mu)}} \\ &= \frac{1}{\frac{1}{0!} + \frac{(2,16/0,5725)^1}{1!} + \frac{(2,16/0,5725)^2}{2!} + \frac{(2,16/0,5725)^3}{3!} + \frac{(2,16/0,5725)^4}{4!} + \frac{(2,16/0,5725)^5}{5(1-2,16/2,862)}} \\ &= \frac{1}{1 + 3,7729 + 7,1175 + 8,9513 + 8,4431 + 25,9603} \\ &= \frac{1}{55,2451} = 0,0181 \end{aligned}$$

- Menghitung jumlah pelanggan yang diperkirakan dalam antrian

$$\begin{aligned} N_q &= \frac{\lambda \mu (\lambda/\mu)^s}{(s-1)!(s\mu - \lambda)} \cdot P_0 \\ &= \frac{(2,16)(0,5725)(2,16/0,5725)^5}{(5-1)!(2,29 - 2,16)^5} \\ &= \frac{43,4316}{0,4056} \cdot 0,0181 \\ &= 1,9382 \end{aligned}$$

- Menghitung jumlah pelanggan yang diperkirakan dalam sistem

$$\begin{aligned}
 N_t &= N_q + \frac{\lambda}{\mu} \\
 &= 1,9382 + \frac{2,16}{0,5725} = 5,7111
 \end{aligned}$$

- Menghitung waktu rata-rata dalam antrian

$$\begin{aligned}
 T_q &= \frac{PO}{\mu s (s!) [1 - (\lambda/s\mu)]^2} \cdot \left(\frac{\lambda}{\mu}\right)^s \\
 &= \frac{0,0181}{(0,5725) (5) (120) (1 - 2,16/2,625)^2} \cdot \left(\frac{2,16}{0,5725}\right)^5 \\
 &= \frac{0,0181}{20,6885} \cdot 764,5243 \\
 &= 0,6689
 \end{aligned}$$

- Menghitung waktu rata-rata dalam sistem

$$\begin{aligned}
 T_t &= T_q + \frac{1}{\mu} \\
 &= 0,6689 + \frac{1}{0,5725} = 2,4156
 \end{aligned}$$

- Menghitung probabilitas untuk menunggu

$$\begin{aligned}
 PW &= \left(\frac{\lambda}{\mu}\right)^s \cdot \frac{PO}{s! (1 - (\lambda/s\mu))} \\
 &= \left(\frac{2,16}{0,5725}\right)^5 \cdot \frac{0,0181}{s! (1 - (2,16/2,8625))} \\
 &= 764,5243 \cdot \frac{0,0181}{29,4498} = 0,4699
 \end{aligned}$$

➤ **Menghitung tambahan biaya fasilitas pelayanan**

$$\begin{aligned} E(cs) &= c \times \text{biaya fasilitas} \\ &= 5 \times 4.887,82 \\ &= 24.439,1 \end{aligned}$$

➤ **Menghitung tambahan biaya waktu tunggu**

$$\begin{aligned} E(cw) &= Nt \times \text{biaya tunggu} \\ &= 5,7111 \times 7500 = 42.833,25 \end{aligned}$$

➤ **Menghitung biaya total**

$$\begin{aligned} Tc &= E(cs) + E(cw) \\ &= 24.439,1 + 42.833,25 \\ &= 67272.35 \end{aligned}$$

## Perhitungan 6 fasilitas pelayanan

- Menghitung tingkat kegunaan fasilitas pelayanan

$$P = \frac{\lambda}{s \cdot \mu}$$
$$= \frac{2,16}{6(0,5725)} = \frac{2,16}{3,435} = 0,6288$$

- Menghitung probabilitas tidak ada individu dalam sistem

$$P_0 = \frac{1}{\sum_{n=0}^{s-1} \frac{[(\lambda/\mu)^n]}{n!} + \frac{(\lambda/\mu)^s}{s!(1-\lambda/s\mu)}}$$
$$= \frac{1}{\frac{1}{0!} + \frac{(2,16/0,5725)}{1!} + \frac{(2,16/0,5725)^2}{2!} + \frac{(2,16/0,5725)^3}{3!} + \frac{(2,16/0,5725)^4}{4!} + \frac{(2,16/0,5725)^5}{5!} + \frac{(2,16/0,5725)^6}{6!(1-2,16/3,435)}}$$
$$= \frac{1}{1 + 3,7729 + 7,1175 + 8,9513 + 8,4431 + 6,3710 + 10,7933} = \frac{1}{46,4491}$$
$$= 0,0215$$

- Menghitung jumlah pelanggan yang diperkirakan dalam antrian

$$N_q = \frac{\lambda \mu (\lambda/\mu)^s}{(s-1)!(s\mu - \lambda)^2} \cdot P_0$$
$$= \frac{(2,16)(0,5725)(2,16/0,5725)^6}{(6-1)!(3,435 - 2,16)^2} \cdot 0,0215$$
$$= \frac{3566,9646}{195,075} \cdot 0,0215$$
$$= 0,3931$$

- Menghitung jumlah pelanggan yang diperkirakan dalam sistem

$$\begin{aligned}
 N_t &= N_q + \frac{\lambda}{\mu} \\
 &= 0,3931 + \frac{2,16}{0,5725} = 4,1660
 \end{aligned}$$

- Menghitung waktu rata-rata dalam antrian

$$\begin{aligned}
 T_q &= \frac{P_0}{\mu s (s!) [1 - (\lambda / s\mu)]^2} \left( \frac{\lambda}{\mu} \right)^s \\
 &= \frac{0,0216}{0,5725 (6) (720) [1 - (2,16/3,435)]^2} \cdot \left( \frac{2,16}{0,5725} \right)^6 \\
 &= \frac{0,0215}{340,7424} \cdot 2884,4935 \\
 &= 0,1820
 \end{aligned}$$

- Menghitung waktu- rata-rata dalam sistem

$$\begin{aligned}
 T_t &= T_q + \frac{1}{\mu} \\
 &= 0,1820 + \frac{1}{0,5725} = 1,92887
 \end{aligned}$$

- Menghitung probabilitas untuk menunggu

$$\begin{aligned}
 P_W &= \left( \frac{\lambda}{\mu} \right)^s \frac{P_0}{s! (1 - (\lambda / s\mu))} \\
 &= \left( \frac{2,16}{0,5725} \right)^6 \frac{0,0215}{6! (1 - (2,16/3,435))} \\
 &= 2884,4935 \cdot \frac{0,0215}{44,5415} \\
 &= 1,3923
 \end{aligned}$$

➤ Menghitung tambahan biaya fasilitas pelayanan

$$\begin{aligned} E(cs) &= c \times \text{biaya fasilitas} \\ &= 6 \times 4,887,82 = 29.326,92 \end{aligned}$$

Menghitung tambahan biaya menunggu

$$\begin{aligned} E(cw) &= Nt \times \text{biaya tunggu} \\ &= 4,1660 \times 7500 = 31.245 \end{aligned}$$

➤ Menghitung biaya total

$$\begin{aligned} TC &= E(cs) + E(cw) \\ &= 29.326,29 + 31,245 = 60.571,29 \end{aligned}$$



## Perhitungan 7 fasilitas pelayanan

- Menghitung tingkat kegunaan fasilitas pelayanan

$$P = \frac{\lambda}{s \cdot \mu}$$
$$= \frac{2,16}{7(0,5725)} = \frac{2,16}{4,0075} = 0,539$$

- Menghitung probabilitas tidak ada individu dalam sistem

$$P_0 = \frac{1}{\sum_{n=0}^{s-1} \frac{[(\lambda/\mu)^n]}{n!} + \frac{(\lambda/\mu)^s}{s!(1-\lambda/s\mu)}}$$
$$= \frac{1}{\frac{1}{0!} + \frac{(2,16/0,5725)}{1!} + \frac{(2,16/0,5725)^2}{2!} + \frac{(2,16/0,5725)^3}{3!} + \frac{(2,16/0,5725)^4}{4!} + \frac{(2,16/0,5725)^5}{5!} + \frac{(2,16/0,5725)^6}{6!} + \frac{(2,16/0,5725)^7}{7!(1-2,16/4,0075)}}$$
$$= \frac{1}{1+3,7729+7,1175+8,9513+8,4431+6,3710+4,0063}$$
$$= \frac{1}{44,346}$$
$$= 0,0226$$

- Menghitung jumlah pelanggan yang diperkirakan dalam antrian

$$N_q = \frac{\lambda \mu (\lambda/\mu)^s}{(s-1)!(s\mu - \lambda)^2} \cdot P_0$$
$$= \frac{(2,16)(0,5725)(2,16/0,5725)^7}{(7-1)!(4,0075 - 2,16)^2} \cdot 0,0226$$
$$= 0,1238$$

- Menghitung jumlah pelanggan yang diperkirakan dalam sistem

$$\begin{aligned} N_t &= N_q + \frac{\lambda}{\mu} \\ &= 0,1238 + \frac{2,16}{0,5725} = 3,8967 \end{aligned}$$

- Menghitung waktu rata-rata dalam antrian

$$\begin{aligned} T_q &= \frac{P_0}{\mu \cdot s! [1 - (\lambda / s \cdot \mu)]^2} \cdot \left( \frac{\lambda^s}{\mu} \right) \\ &= \frac{0,0226}{0,5725 (7) (5040) [1 - (2,16/4,0063)]^2} \cdot \left( \frac{2,16}{0,5725} \right)^7 \\ &= 0,0573 \end{aligned}$$

- Menghitung waktu rata-rata dalam sistem

$$\begin{aligned} T_t &= T_q + \frac{1}{\mu} \\ &= 0,0573 + \frac{1}{0,5725} = 1,8040 \end{aligned}$$

- Menghitung probabilitas untuk menunggu

$$\begin{aligned} P_w &= \left( \frac{\lambda}{\mu} \right)^s \frac{P_0}{s! (1 - (\lambda / s \mu))} \\ &= \left( \frac{2,16}{0,5725} \right)^s \frac{0,0226}{7! (1 - (2,16/4,0063))} \\ &= 0,0905 \end{aligned}$$

- Menghitung tambahan biaya fasilitas pelayanan

$$\begin{aligned} E(c_s) &= c \times \text{biaya fasilitas} \\ &= 7 \times 4.887,82 = 34.214,74 \end{aligned}$$

- Menghitung tambahan biaya waktu tunggu

$$\begin{aligned} E(c_w) &= N_t \times \text{biaya tunggu} \\ &= 3,8967 \times 7500 \\ &= 29.225,25 \end{aligned}$$

- Biaya total

$$\begin{aligned} TC &= E(C_s) + (C_w) \\ &= 34.214,74 + 29.225,25 \\ &= 63.439,99 \end{aligned}$$

## Perhitungan 8 fasilitas pelayanan

- Menghitung tingkat kegunaan fasilitas pelayanan

$$\begin{aligned} P &= \frac{\lambda}{s \cdot \mu} \\ &= \frac{2,16}{8 \cdot 90,5725} \\ &= 0,4716 \end{aligned}$$

- Menghitung probabilitas tidak ada individu dalam sistem

$$\begin{aligned} P_0 &= \frac{1}{\sum_{n=0}^{s-1} \frac{(\lambda/\mu)^n}{n!} + \frac{(\lambda/\mu)^s}{s!(1-\lambda/s\mu)}} \\ &= \frac{1}{1 + \frac{(2,16/0,5725)}{1!} + \frac{(2,16/0,5725)^2}{2!} + \frac{(2,16/0,5725)^3}{3!} + \frac{(2,16/0,5725)^4}{4!} + \frac{(2,16/0,5725)^5}{5!}} \\ &= \frac{(2,16/0,5725)^6}{6!} + \frac{(2,16/0,5725)^7}{7!} + \frac{(2,16/0,5725)^8}{8!(1-2,16/4,58)} \\ &= \frac{1}{1+3,7729+7,1175+8,9513+8,4431+6,3710+4,0063+2,1593+1,9273} \\ &= \frac{1}{4,6839} \\ &= \frac{1}{43,7487} \\ &= 0,0229 \end{aligned}$$

- Menghitung jumlah pelanggan yang diperkirakan dalam antrian

$$\begin{aligned}
 Nq &= \frac{\lambda \mu (\lambda / \mu)^s}{(s-1)!(s\mu - \lambda)^2} \cdot P_0 \\
 &= \frac{(2,16)(0,5725)(2,16/0,5725)^8}{(8-1)!(4,58-2,16)^2} \cdot 0,0229 \\
 &= \frac{50775,6303}{29516,256} \cdot 0,0229 \\
 &= 0,0394
 \end{aligned}$$

- Menghitung jumlah pelanggan yang diperkirakan dalam sistem

$$\begin{aligned}
 Nt &= Nq + \frac{\lambda}{\mu} \\
 &= 0,0394 + \frac{2,16}{0,5725} = 3,81323
 \end{aligned}$$

- Menghitung waktu rata-rata dalam antrian

$$\begin{aligned}
 Tq &= \frac{P_0}{\mu s (s!) [1 - (\lambda / s\mu)]^2} \left( \frac{\lambda}{\mu} \right)^s \\
 &= \frac{0,0229}{0,5725 (8) (40320) [1 - (2,16/34,58)]^2} \cdot \left( \frac{2,16}{0,5725} \right)^8 \\
 &= \frac{0,0229}{51556,7790} \cdot 41060,6747 \\
 &= 0,0182
 \end{aligned}$$

- Menghitung waktu rata-rata dalam sistem

$$\begin{aligned}
 Tt &= Tq + \frac{1}{\mu} \\
 &= 0,0182 + \frac{1}{0,5725} = 1,7649
 \end{aligned}$$