DESPACITO SOLUTION

$\lambda = 15 \frac{\text{customer/employees}}{\text{hour}}$

Service time = 3 min (Average) $\rightarrow$ $\mu = 20 \frac{\text{customer/employees}}{\text{hour}}$

Service time of the new machine = 2 min $\rightarrow$ $\mu = 30 \frac{\text{customer}}{\text{hour}}$

Wage of employee = 8 €/h

Question 3.1. rent of the new machine 2 €/h more than the OLD one.

M/M/1 $\rightarrow$ $W_s = \frac{1}{\mu - \lambda}$

W_s OLD MACHINE $= 0{,}2\ h \simeq 12$ min

W_s NEW MACHINE $= 0{,}0\overline{6}\ h \simeq 4$ min

with $\lambda = 15 \frac{\text{employees}}{h}$

OLD MACHINE $\rightarrow$ $8 \frac{€}{h} * 15 \frac{\text{employees}}{h} * 0{,}2 \frac{h}{\text{employee}} = 24$ €/h

NEW MACHINE $\rightarrow$ $8 \frac{€}{h} * 15 \frac{\text{employees}}{h} * 0{,}0\overline{6} \frac{h}{\text{employee}} + 2 \frac{€}{h} = 10$ €/h

Δ COST for the renting

YES THE COMPANY SHOULD RENT THE NEW MACHINE.

Question 3.2

? $P(n \geq 4)$

$M/M/1 \rightarrow P(n \geq k) = \rho^k$

$$P(n \geq 4) = \left(\frac{\lambda}{\mu}\right)^4 = \left(\frac{15}{20}\right)^4 = 0{,}3164 * 60 \frac{min}{h}$$

$$= 18{,}98 \frac{min}{h}$$

Question 3.3. $\rightarrow$ $M/M/c \rightarrow$? c

W_S (TARGET) < 15 minutes

$\lambda = 15 \frac{employees}{h}$

$\mu = 5 \frac{employees}{h}$

$\Big\} \rho = 3$

$M/M/c \rightarrow W_S = \frac{L_q}{\lambda} + \frac{1}{\mu} < 15$ minutes

$\downarrow$

$L_q < 0{,}75$

$L_q(\rho; c) < 0{,}75 \rightarrow c = 5$