CS350 Assignment 4

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Written Part

Problem 1

$T_s = 0.18$ $\rho = 5 * 0.18 = 9$

a)

i) M/M/1

ii) $q = \frac{\rho}{1-\rho} = \frac{0.9}{0.1} = 9$

iii) $T_q = \frac{q}{\lambda} = \frac{9}{5} = 1.8$

iv) 0.9

v) $\frac{T_q}{T_s} = \frac{1.8}{0.18} = 10$

b)

i) M/G/1

ii) $\sigma^2_{T_s} = \frac{1}{12}(0.3 - 0.06)^2 = 0.0048 \longrightarrow \sigma_{T_s} = \sqrt{0.0048} = 0.069282$

$A = \frac{1}{2}(1 + \frac{\sigma_{T_s}}{T_s}^2) = \frac{1}{2}(1 + (\frac{0.069282}{0.18})^2) = 0.574$

$q = \frac{\rho^2 A}{1-\rho} + \rho = \frac{0.9^2 0.574}{0.1} + 0.9 = 5.54$

iii) $T_q = \frac{q}{\lambda} = \frac{5.54}{5} = 1.1$

iv) 0.9

v) $\frac{T_q}{T_s} = \frac{1.1}{0.18} = 6.1$

c)

i)M/D/1

ii) $q = \frac{\rho^2}{2(1-\rho)} + \rho = \frac{.9^2}{2(.1)} + .9 = 4.95$

iii) $T_q = \frac{q}{\lambda} = \frac{4.95}{5} = 0.99$

iv)0.9

v) slowdown $= \frac{T_q}{T_s} = \frac{0.99}{0.18} = 5.5$

d)

i)M/M/1/K

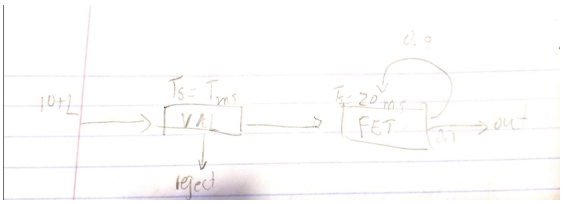
ii) $q = \frac{\rho}{(1-\rho)} - \frac{K+1\rho^{K+1}}{1-\rho^{K+1}} = \frac{0.9}{(0.1)} - \frac{5+1(0.9)^{5+1}}{1-0.9^{5+1}} = 2.2$

iii) $T_q = \frac{q}{\lambda} = \frac{2.2}{5} = 0.44$

iv) 0.9

v)Pr("Rejection")$=\frac{(1-\rho)\rho^K}{1-\rho^{K+1}} = \frac{(0.1)0.9^5}{1-0.9^6} = 0.1260$

Problem 2



a) $UTIL_{VAL} = \lambda T_s = 10 + L * Tms$

b) $\lambda = 10$ for valid requests. $UTIL_{FET} = (10 + (10 \times 0.9)) \times 20ms = 19 \times 0.02 = 0.38$

c) It will blow up if the utilization of either VAL or FET gets bigger than 1

d) $q_{VAL} = \frac{\rho}{1-\rho} = \frac{10+L*Tms}{1-(10+L*Tms)}$

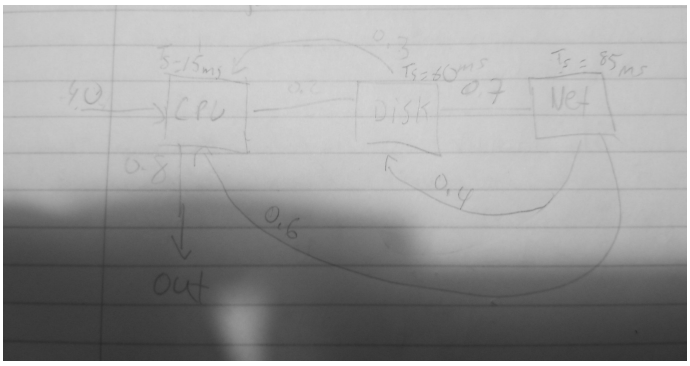
$q_{FET} = \frac{\rho}{1-\rho} = \frac{0.38}{0.62} = 0.613$

$q_{TOT} = q_{VAL} + q_{FET} = \frac{10+L*Tms}{1-(10+L*Tms)} + 0.613$

e) There is no fixed slowdown

Problem 3

a)



b) The disk is the bottleneck because it has the highest utilization.

$\lambda_{CPU} = 50 \longrightarrow \rho_{CPU} = 50 * 0.015 = 0.75$

$\lambda_{NET} = 9.72 \longrightarrow \rho_{NET} = 9.72 * 0.085 = 0.8262$

$\lambda_{DISK} = 13.88 \longrightarrow \rho_{DISK} = 13.88 * 0.06 = 0.8328$

c) The average number of processes present in the above system is 12.67

$q_{CPU} = \frac{\rho}{1-\rho} = \frac{0.75}{0.25} = 3$

$q_{NET} = \frac{\rho}{1-\rho} = \frac{0.8262}{0.1738} = 4.75$

$q_{DISK} = \frac{\rho}{1-\rho} = \frac{0.8328}{0.1672} = 4.98$

$q_{TOTAl} = 3 + 4.75 + 4.92 = 12.67$

d) $T_q = \frac{q}{\lambda} = \frac{12.67}{40} = 0.31675$