CS350 Assignment 2

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Written Part

Problem 1

a) The probability of all bits being transmitted correctly is $0.8^{32} = 0.00079$

b) The probability that SEC-DED can detect an error but not correct it is $0.2^2 = 0.04$

c) The probability that there are exactly two bits incorrectly flipped in a memory word, if we already know that one bit is flipped incorrectly is 0.04, these events are independent of each other. Normally $P(A|B) = \frac{P(A \cap B)}{P(B)}$, but if those events are independent of each other then $P(A|B) = P(A)$

d) Similar to part c. These 2 events are independent therefore the probability of an error being corrected by the SEC-DED is $0.2^1 = 0.2$

Problem 2

a) According to Little's law the average length of time each of this connection last is $T_q = \frac{q}{\lambda} = \frac{21}{48} = 0.4375$ second

b) The average duration a connection must wait before it is handled by the server is $0.4375 \times 21 = 9.1875 seconds$

c) Slowdown is $\frac{T_q}{T_s} = \frac{0.4374}{0.05} = 8.748$

d) Utilization is $\lambda T_s = 48 \times 0.05 = 2.4$. So we must have at least 3 CPUs and the level of parallelism is 2.4.

e) The utilization of each of the CPUs in server, $\frac{2.4}{3} = 0.8$

f) Each CPU must process $\frac{48}{3} = 16$ requests per seconds

g) The utilization of each server would be $\frac{0.8}{3} = 0.267$ The number of request processed by CPU's would be $\frac{16}{3} = 5.333$. So basically 6.

h) The assumption made is that the load were balanced amongst CPUs and that those CPUs were identical.

Problem 3

a) P = 0.8, $\mu = \frac{1}{1-P} = \frac{1}{0.2} = 5$

b) P = 0.2,The probability that attempting to send 8 different packets and it ending in an interruption $f(8) = (1-P)^x = (0.8)^8 = 0.16777216$

c) P = 0.8, the probability of getting 32 or more packets dropped is $1 - P^x$, where x = 31

$1 - (0.8^{31}) = 0.99901$

d) P = 0.2, $\binom{n}{x} \times P^x \times (1-P)^{n-x} = \binom{64}{1} \times 0.2^1 \times (0.8)^{63} = 0.00001$

e) P = 0.2, $1 - \binom{n}{x_i} \times P^{x_i} \times (1-P)^{n-x_i}$, where i = 0,1,2

$1 - ((\binom{64}{0} \times 0.2^0 \times (0.8)^{64}) - ((\binom{64}{1} \times 0.2^1 \times (0.8)^{63}) - ((\binom{64}{2} \times 0.2^2 \times (0.8)^{62}) =$
$1 - (6.27 \times 10^-7) - (0.00001) - (0.00007) = 0.99991$

f) P = 0.2, $\mu = \frac{1}{1-P} = \frac{1}{0.8} = 1.25$

g) $\mu = n \times P = 128 \times 0.2 = 25.6 \approx 26$