CS350 Assignment 3

Chris-Emio (chrisr98@bu.edu)

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Written Part

Problem 1

a) To get the standard deviation $\frac{\sqrt{n}(confidence\ interval)}{t*2} = \frac{\sqrt{36}(15-1.5)}{1.64*2} = 24.7$

b) $Z = \frac{X-\mu}{\sigma} = \frac{16-15}{24.7} = 0.04$ According to the Z table the probability is 51.6%

c) $1 - \frac{\alpha}{2} = 1 - \frac{0.05}{2} = 0.975$

$Z_{\frac{\alpha}{2}}$(lookup for 0.975) $= 1.96$

$E = 1.96\frac{24.7}{\sqrt{16}} = 12.103$

$N = \frac{1.96}{12.103}^2 24.7^2 = 16$

Yes you can.

d) $E = 2.575\frac{24.7}{\sqrt{36}} = 10.6$

95% confidence interval: $[\bar{X} - 10.6, \bar{X} + 10.6]$

e) I would expect the error to have a smaller range.

f) We set E to 0.75 and solve for N

$0.75 = Z_{\frac{\alpha}{2}} \times \frac{\sigma}{\sqrt{N}} = 1.645 \times \frac{24.7}{\sqrt{N}}$

$N = 2935$ So we need 2935-36=2899

Problem 2

$\lambda = 120$ req/m or $\lambda = 2$ req/s, $Ts = 0.4$

a) The exponential distribution $e^{-\lambda x} = 7.66 \times 10^-53$

b) $1 - \rho = 1 - (\lambda T_s) = 1 - (2 \times 0.4) = 1 - 0.8 = 0.2$

c) $q = \frac{\rho}{1-\rho} = \frac{0.8}{0.2} = 4$

$T_q = \frac{q}{\lambda} = \frac{4}{2} = 2$

d) T_q must equal $\frac{4}{3}$ to have a response time that is three times as fast

$T_q = \frac{q_{new}}{\lambda} = \frac{8}{3}$ So the new $\rho = \frac{8}{11} = \lambda \times T_s(0.3636)$

Therefore the processor needs to be 0.4-0.3636 = 0.1363 faster.

Problem 3

1440 mins = 86400 secs

a) We need to process 30000 request per 86400 seconds. $\frac{30000}{86400} = 0.3472$ req/sec.

$20 = \frac{\rho}{1-\rho} \implies \rho = 0.952$

$0.952 = 0.3472 \times T_s \implies T_s = 2.742$ seconds

b) $T_q = \frac{q}{\lambda} = \frac{20}{0.347} = 57.6$

c) We should update because our current utilization (0.952) is greater $\frac{45}{60} = 0.75$

d) Slowdown $= \frac{T_q}{T_s} = \frac{57.6}{2.742} = 21$

e) Maximum number $= \frac{3600}{2.742} = 1312$

f) The amount of memory used is 2MB $\times 20 = 40MB$