

EE 633, Queueing Systems (2016-17F)
Quiz – II

Consider an M/G/1 queue where, if the idle period is longer than T (fixed), then **the first customer in the busy period following that idle period** requires special service with service time X^* (mean $\overline{X^*}$, second moment $\overline{X^{*2}}$, pdf $b^*(t)$ and LT of pdf $L_{B^*}(s)$). All other customers are served with the normal service time X (mean \overline{X} , second moment $\overline{X^2}$, pdf $b(t)$ and LT of pdf $L_B(s)$). Consider the queue to be in equilibrium with arrivals coming from a Poisson process with average rate λ .

- (a) Use the Busy Period approach to find - **(1+2)**
 (i) The probability of the server being idle
 (ii) The overall mean service time X .
- (b) What will be the Mean Residual Service Time that will be observed by an arriving customer? **(4)**
- (c) Write the State Transition Equations relating n_i to n_{i+1} for this queue. **(1)**
- (d) Use the equation of (c) to confirm your result of part (i) of (a). **(2)**
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Bonus Questions:

- (e) Continue the analysis of (b) to find W_q , the mean waiting time in queue, for this system. Use it to find the mean transit time W through the system **(1+2)**
- (f) Continue the analysis using the equation of (c) to find $P(z)$, the generating function of the number in the system. **(2)**

Note: Try the bonus questions only if you have time after you complete parts (a)-(d). **There will not be any part marking for the bonus questions** and the final answer given for these must be *adequately* simplified