Fall 2011 **Mahmut Parlar**

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McMaster University—DeGroote School of Business
Bus O711: Operations Analysis Under Uncertainty
Assignment #2 (Queueing Theory—Part 1)
Due Date: TBA
Late assignments will not be accepted!

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Question	1	2	3	4	5	TOTAL
Mark	20	20	20	20	20	100

1. **Textbook[1] problem 17.2.2, p. 814 (Newell and Jeff)**

2. **Textbook problem 17.2.5, p. 814 (Midtown Bank)**

3. **Textbook problem 17.4.3, p. 815 (Machine repair)**

4. **Textbook problem 17.5.6 (except part f), p. 816 (Maintenance)**

5. **Pizza Industry**

   You are doing an industry analysis of the Hamilton pizza industry. The rate (per year) at which pizza restaurants enter the industry is given by p, where $p =$ price of a pizza in \$. The price of a pizza is assumed to be $\max(0, 16 - .5j)$, where $j =$ number of pizza restaurants in Hamilton. During a given year the probability that a pizza restaurant fails is $1/(10 + p)$. Create a birth-death model of this situation.

   (a) In the steady state, estimate the average number of pizza restaurants in Hamilton.

   (b) What fraction of the time will there be more than 20 pizza restaurants in Hamilton?

   HINT: Birth rate λ_j in this problem is thus $\lambda_j = p = \max(0, 16 - .5j)$ (state dependent) and the death rate is $\mu_j = j/(10 + p)$ (also state dependent).

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[1]F. S. Hillier and G. J. Lieberman, "Introduction to Operations Research," 9th Edition, McGraw-Hill, 2009.

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