

**ISyE 3232A Exam # 1**  
**Fall 2012**

**Name**

Please be neat and show all your work so that I can give you partial credit.  
GOOD LUCK.

**Question 1**  
**Question 2**  
**Question 3**  
**Question 4**  
**Total**

(25) **1.** A news vendor buys newspapers at the start of every day to sell on the street corner. Each newspaper costs 0.15 and is sold for 0.25. Any unsold newspapers will be bought back by the supplier for 0.10. After observing demand for a few months, the news vendor has determined that daily demand follows a discrete uniform distribution between 21 and 40 newspapers.

(a) (10) How many newspapers should the vendor purchase at the beginning of each day to maximize his expected profit?

(b) (15) What is the maximum expected daily profit?

(25) **2.** Consider a family of 3. Suppose it is the flu season. Let 0.6 be the probability that a healthy member of the family is infected by the flu virus in one day, independently of the others. Let  $X_n$  be the number of healthy family members on day  $n$ . Is  $\{X_n : n \geq 0\}$  a Markov chain? Why? If it is, what are the state space and the probability transition matrix?

(25) **3.** Consider a queueing system with a single server. The interarrival times are deterministic and equal to 1.2 hours. The service times of the server (in hours) have the following density function  $f(x) = 2 - 2x$  for  $0 \leq x \leq 1$ .

(a) (15) What is the expected amount of time that the customers spend in this system in the long run?

(b) (5) What is the expected number of customers in the system in the long run?

(c) (5) What is the system throughput?

(25) 4. An auto collision shop has roughly 10 cars arriving per week for repairs. A car waits outside until it is brought inside for bumping. After bumping, the car is painted. On the average, there are 20 cars waiting outside in the yard to be repaired, 10 cars inside in the bump area, and 5 cars inside in the painting area. What is the average length of time a car is in the yard, in the bump area, and in the painting area? What is the average length of time from when a car arrives until it leaves?