Urban Operations Research
1999 Quiz 1

This possible problem notwithstanding, please answer all questions, showing all work. Good luck.

1. At a particular ATM, customers arrive singly in Poisson manner with parameter (= 0.5. There is one server, the queue discipline is first-come first-served, and each service takes exactly one time unit to complete.

(i) Suppose that Mendel arrives at a random time. How long on average will he spent in the system (until his service completion)?

(ii) Minerva arrives at a random time to find six customers in the system. What is the probability distribution of her time in the system?

(iii) If a busy period has just begun for the server, what is the minimum time it could last, and what is the probably it attains that minimum?

iv) If a busy period has just begun, what is its mean duration given that it is longer than the minimum value in (iii)? (HINT: What is the overall mean busy period?)

2. Suppose that x1 and x2 are U(0,a), and let J(a) = E(x12 + x22). Use Crofton's method to determine J(a).

3. Suppose that a city has the shape of a square with side L with the lower left corner at (0,0) , and that it has a diagonal barrier along y=x up to the corner at (L, L). There is one break in the barrier at (.8L,.8L), through which traffic can pass.

Suppose that emergencies occur uniformly over the city, and the response vehicle starts out from a location that is also uniform over the city. (The locations of the emergency and of the starting response vehicle are independent.) The streets follow the Manhattan-metric grid scheme. What is the average distance the vehicle travels to the scene of an emergency?