

**ORII (MEL868) MAJOR TEST (MAY2007)**  
**The method used is very important**

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Q1. Arrivals are coming in at a counter with an exponential distribution having rate 10 per hour. The service distribution is Erlang (2) & the mean service time is 5 minutes. The maximum number of customers allowed in the system is 2. Find the percentage of customers lost by two different methods. Also the probability that the system is empty.

[20]

Q2. A certain security price follows a geometric Brownian motion, with drift parameter  $\mu = 0.05$  & volatility parameter 0.2. The present price of the security is 96.

- (a) If the interest rate is 6%, find the no-arbitrage cost of a call option that expires in 4 months & has an exercise price of 100.
- (b) What is the probability that the call option in part (a) will be exercised.
- (c) Consider an investment that for an initial cost B returns you 110 in 4 months if the price at that time is less than 80% of what it initially was but returns you 0 otherwise. What is the value of B for there to be no arbitrage.

[15]

Q3. A company can be in one of three states, Good (G), Medium (M) & Bad (B). It moves from G to G, M & B with probabilities 0.6 (10), 0.3 (5) & 0.1 (1), from M to G, M & B 0.2 (7), 0.7 (3) & 0.1 (0) & from B to G, M & B 0.1 (5), 0.1 (2) & 0.8 (-4). The rewards in Rs. associated with these movements are given in the brackets. The company is considering a proposal to do research when it is in the Good state (G) & in the Bad state (B). This would change the probabilities & the rewards from G to G, M & B to 0.8 (7), 0.1 (3) & 0.1 (0) & from B to G, M & B to 0.3 (2), 0.4 (1) & 0.3 (-10). Use the policy iteration method to find out what the company should do in the long run in each state.

[5]

Q4. One server is serving two counters exponentially. The arrival rates at the two counters, 6 & 10 per hour, are Markovian. The mean service times are 8 minutes & 5 minutes respectively. A maximum of 1 person is allowed at each counter. (including the person being served). Which queue should the server attend to first when there are two people in the system?

[5]