Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Regular Examination January / February 2011

Subject code: 711901 N

Subject Name: Modelling, Analysis & Simulation

Date: 31 /01 /2011 **Time: 02.30 pm – 05.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** (i) What is a "Stochastic model" and how is it different from a Probabilistic model? Which one is superior and how? Give examples to explain. **04**

(ii) How would you define a process of arrival of vehicles on a highway using discrete and continuous distributions? **03**

(b) (i)"Modeling is an idealized representation of reality". Explain **04**

(ii)The probability density function of a random variable x is **03**

$f(x) = k\frac{(2x+1)^2}{3}, [0,1]$,find k.

Q.2 **(a)** What is Gamma Family of distribution? List them along with their mean and variance. Plot the Erlang distribution. **07**

(b) Show that discrete-distribution functions can be considered to provide similar results with large data-base. Explain it through the conversion of a Binomial Distribution to Negative Binomial and Poisson Distribution. **07**

OR

(b) Where & when simulation should be used? **07**

Give steps in simulating a Queuing system with random arrival at 3 arrivals/hour & negative exponential service at 4 departure /hour. How long should we simulate such system and why?

Q.3 **(a)** (i) The reaction time (in seconds) to certain stimulus is a continuous random variable with pdf, **04**

$$\begin{cases} 0.15e^{-0.15(x-5)}; & x \geq 0.5 \\ 0; & otherwise \end{cases}$$

What is the probability that reaction time is at most 0.5 second?

(ii)Find the variance of Poisson Distribution from the basic property of Moments of discrete distributions. What is its M.G.F.? **03**

(b) (i) A parking lot has 100 parking stalls; 200 vehicles enter the lot per day according to Poisson distribution, and the length of time a stall is occupied is negative exponentially distributed with mean of 0.4 day. Determine, **07**

(a) Probability of the lot being empty.

(b) Average number of cars parked.

(ii) Explain in detail:

$p(x) = \binom{n}{x} p^x q^{n-x}, \; p(x) = \frac{m^x e^{-m}}{x!}$

OR

Q.3 **(a)** Arrival at a toll-booth has been observed to follow a Poisson process with an average arrival rate of 30vph.Processingtime of an arrival is approximately exponentially distributed with an average time of $1\frac{1}{2}$ minute. **07**

(i)What is the probability that a vehicle will not have to wait on arrival?
(ii)How many vehicles are expected to be processed on the average?
(iii) What is the expected number of vehicles in the toll-booth?
(iv) What is the average time a driver waits in queue before paying his toll?

(b) Vehicles arrival at a stop sign at an average rate of 300 per hour. Average waiting time at stop sign is 10 seconds per vehicle. If both arrival and departures are exponentially distributed. What are the average queue length and the average waiting time per vehicle? **07**

Q.4 **(a)** What is a "Random Number" and a "Pseudo-Random Number"? Explain. **07**

(b) Generate random number by M.C.T for m=10;a=7;n=3.Give random number and the cycle length of your number. **07**

OR

Q.4 **(a)** (i)What is Monte-Carlo simulation and retrospective Simulation? **07**
(ii) What is Digital- Simulation?

(b) (i) Explain "various steps used in a simulation study". **07**
(ii)How random number generates events how the same number can generates different event?

Q.5 **(a)** Develop a model for state –independent queuing system at a harbor where ships arrive randomly and service is provided in berths is FCFS service discipline. There are no restriction in the Queue and initially only single serving channel is available. **07**

(b) (i)Distinguish between **07**
(a) Deterministic activity and stochastic activity.
(b) Discrete system and continuous system
(c) Endogenous activity and exogenous activity.

OR

Q.5 **(a)** Passengers arrive at a rapid transit facility at the average rate of 1 per minute and is takes an average of 20 seconds to purchase a ticket. **07**

(i) If commuter arrives 2 minute before the train's scheduled starting time if it takes him exactly 1.5 minute to walk down to the platform to board the train after he has purchased the ticket, can the commuter expected to be in train?
(ii) What is the probability that a commuter can be sure to get into the train before it starts.
(iii) How early must the commuter arrive at the station to be 99% sure of getting into the train.

(b) Explain the growth and Decay model. **07**
A certain type of bacteria, given a favorable growth medium, doubles in population every 6.5 hours. Given that there where approximately 100 bacteria to start with, how many bacteria will there be in a day and half?

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