Your Signature ____________________ *This is a closed book exam. Calculators are permitted. There are five problems. Each problem is worth 10 points, for a total of 50 points.*

Show all your work. Correct answers with insufficient or incorrect work will not get any credit.

Score

1. (10)	
2. (10)	
3. (10)	
4. (10)	
5. (10)	
Total. (50)	

Sheets attached: ____________________

1. Suppose that n people, of which k are men, are arranged at random in a line. What is the probability that all the men end up standing next to each other?

2. An assembler of electric fans uses motors from two sources. Company A supplies 90% of the motors, and company B supplies the other 10%. Suppose that 5% of the motors supplied by company A are defective and that 3% of the motors supplied by company B are defective. An assembled fan is found to have a defective motor. What is the probability that this motor was supplied by company B ?

3. Solve the following questions and giving **reasons** for your answer.

(a) Let X be a discrete random variable. Which of the following functions can represent the distribution function F of X:-

(i)	**(ii)**	**(iii)**
$F(x) = \begin{cases} 0 & x \leq -1 \\ 0.6 & -1 < x < 1 \\ 1 & x \geq 1 \end{cases}$	$F(x) = \begin{cases} 0 & x < 0 \\ 0.5 & 0 \leq x < 1 \\ 1 & x \geq 1 \end{cases}$	$F(x) = \begin{cases} 0 & x < 0 \\ 0.4 & 0 \leq x < 1 \\ 0.3 & 1 \leq x < 2 \\ 1 & x \geq 2 \end{cases}$

(b) Decide whether the following statement is true:- "If A, B, and C are pairwise independent events then they are independent events."

(d) Let $X \stackrel{d}{=}$ Binomial $(36, \frac{1}{2})$. Let $\Phi(t) = \int_{-\infty}^{t} dt \frac{e^{-\frac{x^2}{2}}}{\sqrt{2\pi}}$. Find the r, s, t, u, v so that the following approximations are valid:
(i) $P(3 \leq X \leq 20) \approx \Phi(r) - \Phi(s)$
(ii) $P(X = 20) \approx \dfrac{e^{-t} u^{20}}{v}$

4. Suppose the number of earthquakes (X) that occur in a year, anywhere in the world, is a Poisson random variable with mean λ. Suppose that the probability that any given earthquake has magnitude at least 5 on the Richter scale is p. Let B be the number of earthquakes in a year of magnitude at least 5. Find the distribution of B.

5. Let X be a Geometric $(\frac{1}{2})$ random variable and Y be an independent Geometric$(\frac{1}{2})$ random variable. Let $W = \max\{X, Y\}$. Find the distribution of W.