Name _____ ID Number _____

1. Let U be a random variable that follows a Uniform distribution $U(0,1)$. Let us define the random variable Y as follows:

$$Y = -\frac{1}{\lambda}\ln(1-U)$$

where λ is a positive constant. Use any method to find the distribution of Y.

2. Mahua must decide on the courses she wishes to take for the Monsoon semester. She must choose from upper division courses in CS and Statistics. Mahua has to register for (**exactly**) three upper division courses to complete her major requirements. There are 4 CS and 3 Statistics courses being offered.

Let X represent the number of CS courses and Y represent the number of Statistics courses in her final selection. (Assume that selections are made at random.)

Find the joint pmf of X and Y.

3. In Reliability and Survival Analysis, the hazard function specifies the instantaneous rate of failure at time t, **given** that the individual/ item has survived up till that time. It is also called the conditional failure rate, force of mortality, or age-specific failure rate.

For continuous random variables, the hazard rate is given by

$$h(t) = \frac{f(t)}{1 - F(t)}$$

where f and F denote the density and cumulative distribution function respectively.

Consider the Weibull distribution with cumulative distribution function given by

$$F(t) = 1 - e^{-(\lambda t)^{\gamma}}$$

where $\lambda, \gamma > 0$.

Find the hazard function. Provide a **rough sketch** of the hazard function for $\gamma = 0.5, 1, 2$.