Math 3339 Name:

HW #5

You can use the Tables of the Poisson distribution or R to compute the numerical solution of the problems 1-3 below.

(1)[3 Pts] On average, 2.5 telephone calls per minute are received at the UH's switchboard. Assuming that the number of incoming calls per minute follows a Poisson distribution, compute the probability that at any given minute there will be more than 2 calls.

(2)[3 Pts] Suppose that in one year the number of industrial accidents X follows a Poisson distribution with mean 3.0. If each accident leads to an insurance claim of $5,000, how much money would an insurance company need to keep in reserve to be 95 % certain that the claims are covered?

(3)[4 Pts] A delivery company found that the number of complaints was six per years on average. Assuming that the number of complaints follows a Poisson distribution, calculate the probability of having no complaints in

(a) all of next year;

(b) the next quarter.

(4)[4 Pts] You have the following commands in R to compute probabilities associated with binomial, Poisson and negative binomial distributions.

`dbinom(x, size, prob)`: $P(X = x)$ for $X \sim B(size, prob)$
`pbinom(q, size, prob)`: $P(X \leq qx)$ for $X \sim B(size, prob)$
`dpois(x, lambda)`: $P(X = x)$ for $X \sim Poisson(\lambda)$
`ppois(q, lambda)`: $P(X \leq q)$ for $X \sim Poisson(\lambda)$
`dnbinom(x, size, prob)`: $P(X = x)$ for $X \sim NB(size, prob)$
`pnbinom(q, size, prob)`: $P(X \leq qx)$ for $X \sim NB(size, prob)$

Note that the negative binomial rv in R counts the number of failures that occur before getting the desired success. It is not exactly the same as I defined in class but it is closely related.

Use these commands to solve problems (3) and (5)(a-b) from past HW4 and problem (1) in this HW5. Print your result to return your work to me with Quiz #5.

(5)[6 Pts] Let X and Y have the following joint p.d.f.

		x	
y	1	2	3
1	0.05	0.15	0.15
2	0.10	0.10	0.10
3	0.15	0.15	0.05

(a) Calculate the marginal densities. Are X and Y are independent?

(b) Compute the means and variances.

(c) Are X and Y positively correlated? negatively correlated? uncorrelated?

(6)[4 Pts] Let $W = 1 - X + 2Y$ be a discrete random variable where X, Y are independent discrete random variables with $\mu_X = 5$, $\mu_Y = 2$, and $\sigma_Y^2 = 2$, $\sigma_X^2 = 1$. Compute μ_W and σ_W^2.

(7)[Extra Credit] Let X, Y be discrete random variables, where $X = 1, 2, 3, 4$, $Y = 1, 2, 3$, with the joint distribution given by the matrix defined in R below

```
p <- matrix(c(.02,.04,.01,.06,.15,.15,.02,.20,.14,.10,.10,.01),ncol=4)
```

Use R to:

(a) Verify that p is a probability mass function (i.e., check that it sums up to 1)

(a) Define the marginal densities (hint: you can use the `apply` function) and plot them.

(b) Compute the means and variances.

(c) Are X and Y positively correlated? negatively correlated? uncorrelated?