MA 581 Qualifying Exam Problems **April 2018**

Problem 1

The number of students who register for a certain difficult course is distributed Poisson with mean 5. Due to its difficulty, each student has only an 80% chance of finishing that course. Students work independently of one another.

a. What is the probability that no one finishes this course?
b. Last year, that course had no students finishing. Find the probability that exactly 3 registered for that course last year. Interpret your answer appropriately.
c. This course has been run 6 times (under different, independent instructors). What is the probability that a total of 30 students altogether registered for it?

Problem 2

Let X be a rv with pdf given by $f(x) = c/x^3$, for $1 < x < 4$, where c is a constant.

a. Determine the value of c.
b. Find $P(2 < X < 3)$.
c. Find the cdf F of X.
d. Compute $P(X > 2 \mid X < 3)$.
e. Compute E(X).
f. Compute stdev(X).
g. Compute $E[X^3 \cos(X)]$ exactly, then in decimal form.
h. Compute the failure (or hasard) rate R(t) of X, for $1 < t < 4$.
i. Suppose that 10 students each independently generate their own value of X. Find the probability that exactly 7 of those students generate a value greater than 3.
j. Suppose Y is a rv such that X and Y are iid (where X is the rv of this problem). Compute

$$\text{stdev}\,(5X - 3Y + 8).$$