Name: ----------

Directions: **Work only on this sheet** (on both sides, if needed); do not turn in any supplementary sheets of paper. There is actually plenty of room for your answers, as long as you organize yourself BEFORE starting writing.

1. Consider once again the Jack and Jill example, Sec. 3.14.1. Write you answers as a decimal expression, e.g. $\sqrt{0.5^3 - 0.2} \cdot 1.8$.

(a) (20) Find $F_{X_3}(1.3)$.

(b) (15) Find $F_{X_3,Y_3}(1.3, 0.1)$.

2. Consider the Ethernet example, Sec. 5.5.4. Answer the following with either decimal expressions (see above) or integrals. The latter must be definite integrals that calculus students could evaluate to actual numbers.

(a) (10) Find Var(X).

(b) (10) Find $P(X < 0.32)$.

(c) (15) Find $P(X = Y)$.

(d) (15) (**BONUS PROBLEM:** Points plus Extra Credit) Suppose transmission time T for a message is also random, exponentially distributed with mean 0.1. Find $P(X < Y$ and there is no collision).

3. (15) Fill in the following R code to find $P(Y > 552)$ in Sec. 4.4.7.2:

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xpois(blank2, blank3)
```

The "x" here is blank1.

Solutions:

1.a

$$F_{X_3}(1.3) = P(X_3 \leq 1.3) = P(X = 0 \text{ or } X = 1) = (0.5)^3 + 3(0.5)^3$$

1.b

$$\begin{aligned} F_{X_3,Y_3}(1.3, 0.1) &= P(X_3 \leq 1.3, \quad Y_3 \leq 0.1) && (1)\\ &= P[(X = 0 \text{ or } X = 1) \text{ and } (Y = 0)] && (2)\\ &= P(X = 0 \text{ or } X = 1) \cdot P(Y = 0) && (3)\\ &= \left[(0.5)^3 + 3(0.5)^3\right] \cdot 0.5 && (4) \end{aligned}$$

2.a Since $\lambda = 0.01$, then $Var(X) = (1/0.01)^2$ (p.95).

2.b $P(X < 0.32) = \int_0^{0.32} 5e^{-5u}\ du$.

2.c 0

2.d Here T will be the transmission time for X. We need to find $P(X + T < Y)$. Following the computation in Sec. 5.5.6, we have

$$f_{X+T}(v) = e^{-5v} - e^{-10v}$$

So, similar to the reasoning in (5.87), we have

$$P(X + T < Y) = \int_0^{\infty} 5e^{-5w} \int_0^{w} \left[e^{-5v} - e^{-10v}\right]\ dv\ dw$$

3. Use Sec. 4.4.6.1.

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ppois(4,5.52)
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