- Read and attempt to understand Sections 2.8 and 3.1 through 3.3 in the Ross book.
- Continue into Section 3.4 as far as you can (it's 15 pages long).

*Notes: In the 10th edition, this should be Sections 2.9 and 3.1 through 3.3, then 3.4.*



If you roll two 6-sided dice, and you let $X$ equal the total number of dots shown, what is $P(X = 4)$?

A $\frac{1}{3}$ B $\frac{1}{4}$
C $\frac{1}{6}$ D $\frac{1}{12}$

*Notes: Answer: D. Most of the class obtained this answer. In response to a question, I discussed the reasoning.*



A Bernoulli random variable is a special case of which of the following?

A binomial random variable B exponential random variable
C geometric random variable D Poisson random variable

*Notes: Answer: A. This is just terminology, and there were several who did not know the answer.*



Which of the following is the probability mass function for a Poisson random variable?

A $p(i) = p(1-p)^i$ B $p(i) = \binom{n}{p} p^i (1-p)^{n-i}$
C $p(i) = \frac{\lambda^i}{i!} e^{-\lambda}$ D $p(i) = \frac{1}{n}$

*Notes: Answer: C. We also identified A as geometric, B as binomial, and D as discrete uniform.*

If $X$ has a continuous distribution, what is true about its cumulative distribution function $F(x)$?

- A It is strictly increasing.
- B It is everywhere differentiable.
- C It integrates to one.
- D It is continuous.

*Notes: Answer: D. This one was slightly tricky and quite a few people answered A. Also, B was popular, and some said C because they mixed up cumulative distribution function and density function. We saw for a simple example (a uniform cdf) that a continuous cdf need be neither strictly increasing nor everywhere differentiable.*



Which of the following is the probability density function for an exponential random variable?

- A $f(i) = \frac{1}{\beta-\alpha}$
- B $f(i) = \lambda e^{-\lambda x}$
- C $f(i) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/2\sigma^2}$
- D $f(i) = \frac{\lambda e^{-\lambda x}(\lambda x)^{\alpha-1}}{\Gamma(\alpha)}$

*Notes: Answer: B. But also notice that D works in the special case $\alpha = 1$. We identified D as gamma, A as uniform, and C as normal.*



If $X$ has a continuous distribution and a density function $f(x)$, then $E(X) =$?

- A $\int_{-\infty}^{\infty} f(x)\,dx$
- B $\int_{-\infty}^{\infty} xf(x)\,dx$
- C $\int_{-\infty}^{\infty} x^2 f(x)\,dx$
- D $\int_{-\infty}^{\infty} (x-\mu)f(x)\,dx$

*Notes: Answer: B. Most people got this one.*



The variance is...

- A the expectation of the square.
- B the square of the expectation.
- C the expectation of the square plus the square of the expectation.
- D the expectation of the square minus the square of the expectation.

*Notes: Answer: D. Most got this.*

Which is a simpler way to write $\mathrm{Var}(X) + \mathrm{Var}(Y) + 2\,\mathrm{Cov}(X, Y)$?

A $\mathrm{Var}(X + Y)$

B $\mathrm{Corr}(X, Y)$

C $E(X + Y)$

D $E(X + Y)^2$

*Notes: Answer: A. A few weren't sure of this. We didn't spend any time on it, but it's possible to derive this formula without too much difficulty.*



If $X_1, \ldots, X_n$ are independent and identically distributed with mean $\mu$ and variance $\sigma^2$, $\mathrm{Var}\,\overline{X}_n =$?

A $\sigma$

B $\sigma/n$

C $(\sigma/n)^2$

D $\sigma^2/n$

*Notes: Answer: D. This is an important one. For instance, it comes up in the proof of the weak law of large numbers using Chebyshev's inequality later.*



If a Bernoulli($p$) random variable has MGF $\phi(t) = 1 - p + pe^t$, what is the MGF of a binomial($n, p$) random variable?

A $(1 - p + pe^t)^n$

B $n(1 - p + pe^t)$

C $(1 - np + npe^t)$

D $(1 - p + pe^t)/n$

*Notes: Answer: A. Most knew it. We discussed moment generating functions for a few minutes.*



The inequality $P(|X - \mu| \geq k) \leq (\sigma/k)^2$ may be used to prove which of the following?

A The Strong Law of Large Numbers

B The Weak Law of Large Numbers

C The Central Limit Theorem

D Chebyshev's Inequality

*Notes: Answer: B. Few were sure of this. We spent several minutes with the students working together to find a proof of the weak law using Chebyshev's inequality.*

If $X \sim \text{binomial}(100, 1/2)$ and $\Phi(\cdot)$ is the standard normal cdf, which of the following is the best approximation to $P(X \leq 50)$?

A $\Phi(0)$

B $\Phi(0.1)$

C $\Phi(0.2)$

D $\Phi(0.3)$

*Notes: Answer: B. I discussed the continuity correction as it applies here; this continuity correction gives a far more accurate approximation than the more naive choice A. (The true value is 0.53979,* $\Phi(0) = 0.5$*, and* $\Phi(0.1) = 0.53983$*.)*