1. [3 points] Consider the sum of three **4-sided dice**. A four-sided die is shaped like a pyramid made of equilateral triangles, and has the numbers 1,2,3,4 on its sides.
   a. Construct the pdf and cdf for the sum of three 4-sided dice. In 64ths:

	3	4	5	6	7	8	9	10	11	12
Pdf	1	3	6	10	12	12	10	6	3	1
Cdf	1	4	10	20	32	44	54	60	63	64

   b. Using the cdf, show the probability of getting a sum in the range 6 to 8: **(34/64)**

2. [3 points] Consider the sum of 3 coin flips, where heads is assigned the value 1 and tails is assigned the value 0.
   a. What is the mean of the sum of 3 coin flips? What proportion of the time would you expect to see the sum of 3 coin flips take on its mean value? **mean=1.5, 0% of the time**

	0	1	2	3
Pdf	1	3	3	1
Cdf	1	4	7	8

   b. What is the variance of the sum of 3 coin flips? **V=0.75**

3. [1 point] Which of the following is a linear regression model:
   a. $Y_i = \alpha + \beta_1 X_i + \beta_2 X_i^2 + \varepsilon_i$
   b. $\log(Y_i) = \beta_0 + \beta_1 \log(X_i) + \varepsilon_i$
   c. $Y_i = \beta_0 + \beta_1 e^{X_i} + \varepsilon_i$
   d. all of the above
   e. none of the above

4. [2 points] Why does s^2 have *n-1* in its denominator rather than *n*? **So that it is an unbiased estimator of V---they should prove this.**

5. [6 points] Let 2 random variables have the following joint pdf , with *X* in rows, and *Y* in columns:

	Y=-1	*Y*=0	*Y*=1
X=-1	0.125	0.15	0.125
X=0	0	0.2	0
X=1	0.125	0.15	0.125

   a. What is the conditional mean of Y for each value of *X*? ***E[Y|x]=g(x)=0***
   b. What is the covariance of *X* and *Y*? Are *X* and *Y* independent? **Cov(X,Y)=0, not independent (eg, V(X) depends on Y)**
   c. What is the probability that *X=1*? **0.40**
   d. Assume the even simpler regression model $Y_i = \beta X_i + \varepsilon_i$. Given a large number of observations from this joint pdf, what would you expect the estimated coefficient to be? **0--they could work this out by weighting the formula for beta-hat, or argue it from the conditional mean not depending on *X*.**

6. [2 points] Prove that the sample mean is an unbiased estimator of the population mean. Be sure to write down all your assumptions. **standard proof in my notes, or any other**

7. [2 points] Suppose that *Z* is the average of *n* iid observations of a random variable *X*. Suppose that *V*(*X*)=1. Suppose that *n* is very large. Construct a standard normally distributed test statistic for the hypothesis that *X* is drawn from a distribution whose mean is 2. ***(Z-2)/(1/n$^{1/2}$) ~ N(0,1)***

8. [2 points] Consider the even simpler regression model $Y_i = \beta X_i + \varepsilon_i$, where *Y* earnings in thousands of dollars and *X* is age in years. Say that your estimated value of the coefficient is 4, and that the variance of this estimated coefficient is 4.

a. What is estimated difference in earnings between a person who is 25 and a person who is 40? **$60,000**

b. How would you use the tables in the back of your textbook to test the hypothesis that the slope of earnings with respect to age is zero? **find the p-value for a standard normal equal to 4/2=2. they should state whether it is one- or two-sided.**

9. [2 points] Suppose that $X \sim N(0,1)$, $U \sim N(0,1)$ and $Y=2X+U$.

a. What is the conditional expectation of *Y* given that $X=2$? **4**

b. What is the distribution of $Z=X^2+U^2$? **chi-square with 2 df**

10. [2 points] Suppose that $X \sim N(2,2)$ and $Y=2X+5$.

a. What is the mean of *Y*? What is the variance of *Y*? **E[Y]=9; V[Y]=8; Y~N(9,8)**

What is the distribution of *Y*?