

Your Name

Your Signature

**Lecture:**  8:30 Contenza  
 9:30 Garfield

**SI:**  Alex  Avni  Jason  
 Ashley  Becca  Matt

Problem	Total Points	Score
1	40	
2	30	
3	30	
4	30	
5	20	
Total	150	

- You are only allowed to use the attached formula sheet; no other notes are allowed for this exam.
- You may use a calculator, such as a scientific or graphing calculator. You may not use your cellular phone. You are not allowed to share calculators.
- In order to receive partial credit, you must show your work. Be wary of doing computations in your head. Instead, write out your computations on the exam paper.
- Your answers should either be *exact answers* (like  $2\sqrt{2}$ ) or rounded to four digits after the decimal (like 0.1234) in whatever units you're using. Be careful not to round intermediate calculations whenever possible, as you will lose points for errors due to incorrect rounding.
- Please do *not* leave your answers in terms of factorials (like  $3!$ ) or expressions like  $P(5, 2)$  or  $C(4, 2)$ . That is, I would like a numeric answer, if possible.
- If you need more room, use the backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question.
- Good luck!

1 (40 points) Scores on the February 2006 Bar Exam had a normal distribution with mean score 137 and standard deviation 15.

(a) (10 points) Find the probability that a law student scored between 125 and 152 on the exam.

(b) (15 points) Find the probability that a law student scored above 125 on the exam.

(c) (15 points) Horace was not the best of law students. What score did he need on the bar exam to guarantee that he was NOT in the bottom 10% of all test takers in 2006? (Round this score to the nearest integer.)

2 (30 points) An unfair *toonie* (a Canadian \$2 coin) with  $P(H) = .4$  and  $P(T) = .6$  is tossed 4 times. Let  $X$  be the random variable that records the number of heads.

(a) (10 points) List the values of  $X$  together with the probability distribution.

(b) (5 points) Find the expected value of  $X$ .

(c) (15 points) A player's winnings for each possible outcome are shown in the table below.

Number of heads	4	3	2	1	0
Payoff	\$20	\$5	\$0	\$0	$\$N$

If a player pays \$2 to play, how much should he win (or lose) if no heads appear to make the game fair?

3 (30 points) The lifespan of a light bulb is exponentially distributed with standard deviation  $\sigma = 400$  hours.

(a) (10 points) Find the expected lifespan of the light bulb.

(b) (10 points) Find the probability that a light bulb lasts less than 200 hours.

(c) (10 points) Find the probability that a light bulb lasts more than 500 hours.

4 (30 points) Determine the value (if possible) of each integral. Use limits to justify your answer.

(a) (15 points)  $\int_2^{\infty} \frac{1}{(x-1)^2} dx$

(b) (15 points)  $\int_{-1}^2 \frac{8}{x^2} dx$

5 (20 points)

- (a) (10 points) Find the constant  $k$  so that  $f(x) = k\sqrt{5-x}$  is a probability density function on the interval  $[1, 4]$ .

- (b) (10 points) Now consider the probability density function  $f(x) = \frac{30-4x}{100}$  on the interval  $[0, 5]$ . Find the constant  $C$  so that  $P(X \leq C) = \frac{1}{2}$ .