STAT 100
Final Examination

Name_____

Student Number _____

Instructions: This is an open book exam; you are permitted notes, text, and other printed material. You may use a calculator; computers are not permitted. It is a 3 hour long exam. It is out of 40 marks in total. You should have 11 pages; write your answers on this paper. You may use the backs of the pages. If you need a copy of Table B from the textbook some will be available in the exam rooms.

QUESTION 1 [4 marks in total]

Suppose that the Blood Alcohol Content (BAC) of students who drink five beers varies from student to student according to a Normal distribution with mean 0.07 and standard deviation 0.01.

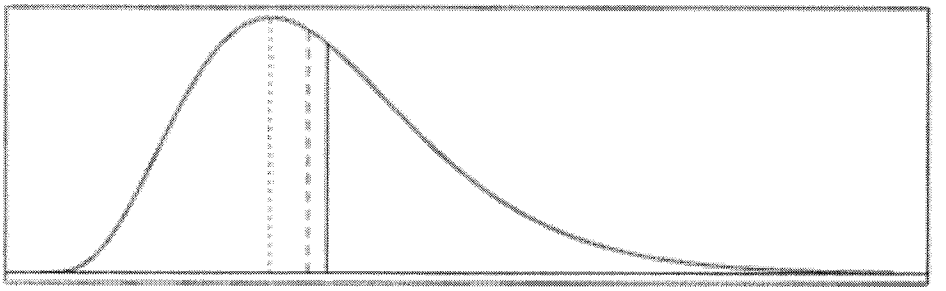
A. About what fraction of students who drink five beers have BAC in the range 0.05 to 0.09? [1 mark]

B. Approximately what is the third quartile of BAC for students who drink five beers? [2 marks]

C. What is the standard score of a student with a BAC of 0.075? [1 mark]

QUESTION 2 [2 marks in total]

The graph below shows a density and three lines; from left to right they are dotted, dashed and solid. One of the lines marks the mean, one marks the median and the third is irrelevant. Which line corresponds to which statistical concept? Explain.



QUESTION 3 [8 marks in total]

Standardized entrance tests are often used in making admissions decisions for universities. A study of 1000 students completing a degree at a large university shows the following results. The students had an average score of 75 on the entrance exam with a standard deviation of 10. Final GPAs (GPAs at graduation) averaged 2.9 with a standard deviation of 0.3. The correlation between entrance test score and final GPA is 0.4.

A. Predict the final GPA of a graduating student whose entrance score is 90. [3 marks]

B. What percentage of variation in final GPA is explained by the entrance test score? [1 mark]

C. Suppose I wanted to guess the entrance test score for a student whose final GPA was 3.5. What is the slope of the relevant regression line? [2 marks]

D. A test preparation company offers a service to help you do better on the entrance exam. They promise that in addition to helping you get in to the university, a better score on the exam will ensure you have a better graduating GPA because of the positive correlation. Criticize this claim; be specific. [2 marks]

QUESTION 4 [7 marks in total]

In this question you need to provide explanations; the quality and clarity of those explanations will be evaluated.

Many games involve throwing a pair of (6-sided) dice and adding up the numbers of spots showing. You get a number from 2 to 12 with the probabilities as recorded in the table below:

2	3	4	5	6	7	8	9	10	11	12
1/36	2/36	3/36	4/36	5/36	6/36	5/36	4/36	3/36	2/36	1/36

A. What are the odds against throwing a 6? [1 mark]

B. A casino posts odds of 34 to 1 against throwing a 2. To what probability of throwing a 2 do those odds correspond? [1 mark]

C. If a very persistent player bet on 2 in 3600 games roughly how much money would the casino expect to make from that player? [2 marks]

D. In the game of craps the "shooter" rolls a pair of dice and "wins" immediately if s/he rolls a 7 or an 11. What is the chance s/he wins immediately? [1 mark]

E. A gambler offers to sell you a pair of dice which s/he claims land 7 or 11 one quarter of the time. If this is true what is the chance you don't win immediately when throwing these dice? [1 mark]

F. S/he also claims they show 2, 3 or 12, one-eighth of the time and 4, 5, 6, 8, 9 or 12 two thirds of the time. Is that possible? Explain. [1 mark]

QUESTION 5 [Total of 2 marks]

IQ scores on a certain test are standardized so that the population mean IQ is 100 and the standard deviation is 15. In many studies it is found that the correlation between a mother's IQ and a child's IQ is around 0.5. A study of the effect of adoption on intelligence measured the IQ of the birth mother, the adopting mother and that of the adopted child 15 years after adoption. [The real study has many complications and the conclusions are more complex than I am looking for here.] Imagine the researchers find that the birth mothers in the study have IQs averaging to around 85 points and that the adopted children had an average IQ of 93 points. The researchers are tempted to explain the improvement in IQ from mother to child in terms of the superiority of the adoptive environment. Suggest another explanation based on the material in this course which requires no environmental effect of adoption.

QUESTION 6 [Total of 2 marks]

An article by Éric Grenier, on the CBC web site on 26 November 2014, describes Canadian attitudes towards the federal political parties. It says "In 28 polls conducted over the last seven months, the Conservatives have averaged 30 per cent, with more than two-thirds of those polls not wavering from that number by more than two points in either direction." If conservative support in Canada has not changed at all over the last seven months and all the polls have the same margin of error, what is that margin of error, roughly? [You may assume that "more than two thirds" doesn't mean much more than two thirds – that is, it means "a little over two-thirds".]

QUESTION 7 [Total of 2 marks]

Multiple choice questions: choose the best answer from each list. No explanation is required. [1 mark each]

A. Were the extinctions that occurred in the last ice age more frequent among species of animals with large body sizes? A researcher gathers data on the average body mass (in kilograms) of all species known to have existed at that time. What are the explanatory and response variables?
   a. There is no explanatory-response distinction in this situation.
   b. Explanatory: body mass of a species. Response: whether the species went extinct.
   c. Explanatory: the ice age. Response: whether a species went extinct.
   d. Explanatory: whether a species went extinct. Response: the body mass of the species.
   e. Explanatory: the ice age. Response: the body mass of a species.

B. A researcher claims that the mean resting pulse rate of all college basketball players in the United States is less than the mean resting pulse rate of all professional basketball players in the United States. The resting pulse rates of a random sample of 115 college basketball players were measured as were the resting pulse rates of a random sample of 80 professional basketball players. The mean resting pulse rates of the two groups were compared.
   An example of a lurking variable that might affect the results of this study is
   a. The team each player is from.
   b. The location where the study was administered.
   c. Whether or not the players had scholarships in college.
   d. The age of the players.

QUESTION 8 [Total of 2 marks]

A study of fires in a city shows that the more firefighters there are attending a fire the more property damage there is. Explain why this is poor evidence that calling in more firefighters causes property damage.

QUESTION 9 [Total of 2 marks]

Does hair colour have predictive validity as a measure of employment? Explain.

QUESTION 10 [Total of 3 marks]

A researcher uses MRI to measure brain size (Vol) and then administers IQ tests. The first 6 subjects data is reported below. I want you to fill in the blanks in the computation of the correlation, r, between Vol and IQ for these 6 subjects. (There are 2 blanks to fill in before you compute r.)

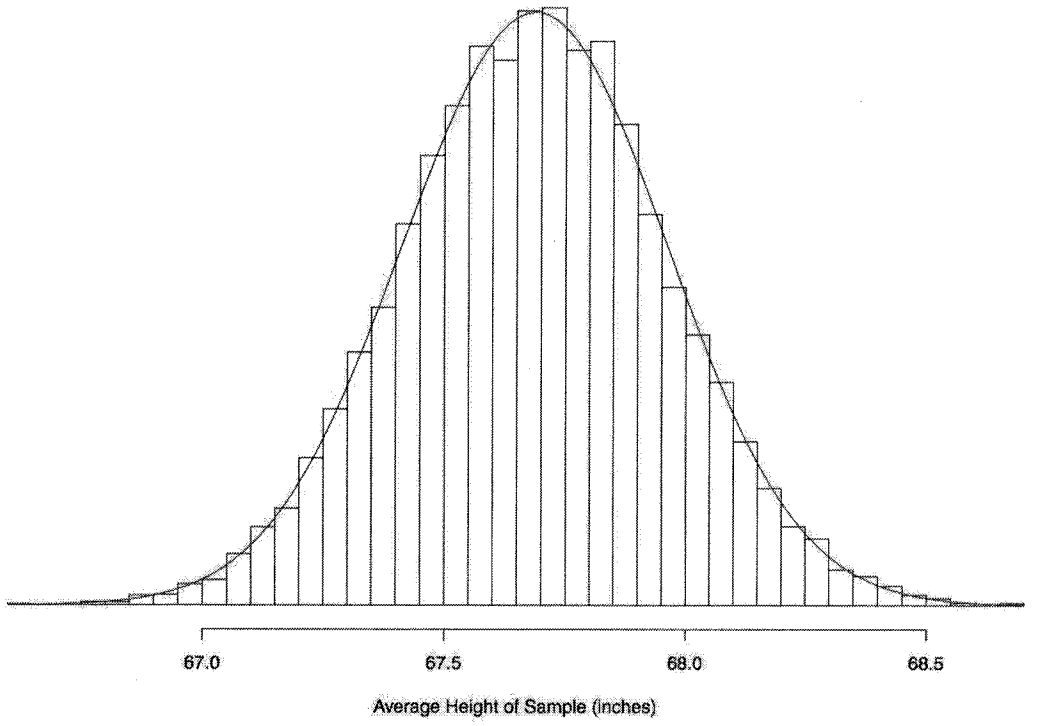
	Vol	IQ	Std Score Vol	Std Score IQ	Product
	100	140	0.71	1.32	0.94
	90	90	-0.76	-0.74	0.57
	95	100		-0.33	0.01
	92	135	-0.47	1.11	-0.52
	88	80	-1.06	-1.15	
	106	103	1.6	-0.2	-0.33
Mean	95.2	108.0			
SD	6.77	24.3		r	

What is the correlation coefficient? (Explain what calculations you made in the rest of the space on this page.)

QUESTION 11 [Total of 3 marks]

Below is a histogram of the sampling distribution for the average height of a sample of size 100 from a large population of men. The histogram has a normal curve drawn on top. The mean of this histogram is 67.69 inches and the SD is 0.27 inches. If I draw a simple random sample of 100 men from this population roughly what is the chance that my sample mean will be between

67.69 – 3*0.27 and 67.69 + 3* 0.27?



QUESTION 12 [Total of 3 marks]

In early October Statistics Canada released unemployment data for September. They reported that there were 43,000 more jobs for young people aged 15 to 24 in September than in October and said the standard error in that number was 15,800. Was this a statistically significant change? Also write a sentence interpreting your answer.