Warning
This practice final does not have box plot questions. There WILL be some on the final! Please study accordingly. You can practice box plots by doing the practice homework on box plots. There are also box plot questions on all exam 2 practice exams.

Stat 100 Final Exam Form is either A B C D E F G H I (you don't know) Spring 2014

PRINT Last Name Key **PRINT** First Name _____

Net ID _____ Signature _____

Instructions- This is a closed book, closed notes exam. You have 3 hours to complete it.

- **Print and your Last and First name, then fill in your Net ID, and signature.**
- **At the end of this exam, you must return this Exam Booklet complete with all pages, and you must put your Scantron inside the booklet. You don't need to show any work on the exam booklet.**
- Use a **#2 pencil**. **Each question has only *one* answer.** If you bubble in more than one answer, it will automatically be marked wrong. Erase mistakes completely.
- This Exam Booklet is **either Form A, B, C, D, E, F, G, H or I (9 different forms).** You don't know which test form you have so you MUST put your Scantron form inside the exam booklet so the TAs can correctly mark the test form box on your Scantron sheet after the exam.

How to fill out the Scantron form

- Print and bubble in your **LAST NAME with NO SPACES** starting in the left most column. Print your **FIRST INITIAL** in the right-most column.
- Print and bubble in your Student ID number (UIN) in the Student Number box.
- In the section box, fill in the corresponding number→

In Section Box: Print and bubble in the number below according to your section
- Section C1 (Karle 10am) use 00002
- Section P1 (Karle 1pm) use 00004
- Section H1 (Karle 12pm) use 00005
- Section F1 (Ellen Fireman) use 00003
- Section G1 (Uma Ravat) use 00001

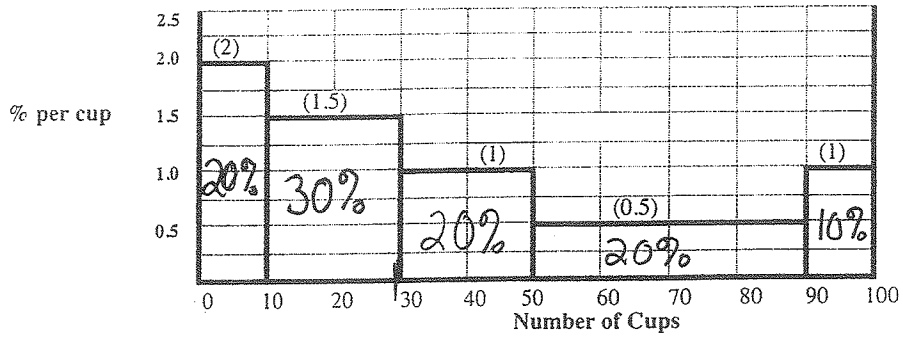
- Print and bubble in the date in the Date box.
- **Leave the FORM box blank.**
- Print and bubble in your NET ID in the NETWORK ID box. This is IMPORTANT, you may lose points if your netid is wrong (e.g. **net id's should have no spaces**; jkim 58 is WRONG, jkim58 is correct).
- Write *STAT 100* on the COURSE line.
- Write *Karle Laska* on the INSTRUCTOR line.
- Write *C1* on the SECTION line.

Final Exam Scores will be posted on Compass on May 16. Bonus Notebook points will be posted on Compass by tomorrow night. Check Compass to make sure your points were recorded.

- **Sign your name, and right underneath the student signature line PRINT your name**

CHECK NOW THAT YOU HAVE COMPLETED ALL OF THE STEPS. Before starting work, check to make sure that your test booklet is complete. You should have **16 pages (100 problems)**, including **3 tables**, the Normal, the *t*-Table and the chi-square table.

Questions 1-8 pertain to the histogram below.
The histogram below represents the number of cups of coffee consumed by a large group of students during the last 2 weeks of the semester. The height of each block is given in parentheses. (Assume an even distribution throughout each interval.)



1) What percent of the students drank between 50-90 cups? a) 10% b) 15% c) 20% d) 25% e) 30%

2) The median is closest to … a) 20 b) 30 c) 40 d) 50 e) 60

3) The average is ___>___ the median. a) less than b) greater than c) equal to

4) The 70th percentile is a) 20 b) 25 c) 30 d) 40 e) 50

5) The percent of students who drank exactly 20 cups of coffee is closest to….. a) 1% b) 1.5% c) 15% d) 2% e) 2.5%

6) If everyone's coffee intake was divided by 2 (so their intake ranged from 0 to 50) then the average would ….
a) be multiplied by 2 b) be divided by 2 c) be multiplied by 4 d) be divided by 4 e)Stay the Same

7) and the SD would ….
a) be multiplied by 2 b) be divided by 2 c) be multiplied by 4 d) be divided by 4 e)Stay the Same

8) If you knew the average and SD displayed in the histogram above, would it be appropriate to use the normal approximation to figure what percentage of the students fell within various intervals?
a) Yes, because we know that the histogram represents the distribution of a large population.
b) Yes, because even though the histogram above is far from normal, the histogram of Z scores will be normal.
c) No, because the histogram is not close enough to following the normal curve; so the approximation would be way off.
d) Maybe, depending on whether the students were randomly drawn from a larger population.

The next 3 questions pertain to this list of 6 numbers: 2, 4, 5, -4, 2, 3

9) The average of the list is… a) 2 b) -1 c) 4 d) 0 e) 3 $\text{ave} = \frac{2+4+5+(-4)+2+3}{6} = \frac{12}{6} = 2$

10) The median of the list is… a) 1.5 b) 2 c) 3 d) 2.5 e) .5 $-4, 2, 2, 3, 4, 5$

11) The deviations from the average of the list are:
a) -1,1,4,-7,-1,0 b) 2,4,5,-4,2,3 c) 3,5,6,-3,3,4 d) 4,6,7,-2,4,5 e) 0,2,3,-6,0,1

Take each number on the list & subtract the average (2)

Questions 12-15 pertain to the following study:
A recent Turkish study declared that flossing prevents Erectile Dysfunction. The study compared two groups: 80 men aged 30-40 with erectile dysfunction, and the comparison group of 82 men aged 30-40 without erectile dysfunction. Dentists analyzed the inflammation of each patient's gums and could tell who had flossed regularly and who hadn't. The results were shocking: men who didn't floss were 3.29 times more likely to have erectile dysfunction than their flossing counterparts.

12) Which of the following statements is best? ***Choose one:***
- a) This was a randomized controlled experiment without a placebo.
- (b) This was an observational study. No treatment was given
- c) This was a non-randomized controlled experiment with a placebo.
- d) This was a randomized controlled double-blind experiment.

The next three questions present scenarios that can be categorized as either a Confounder, Causal Link, or Neither to explain how flossing and erectile dysfunction are related. Correctly identify each scenario.

13) Confidence: Confident men are more likely to be well groomed for the workplace and the bedroom. For example, confident men are more likely to clean their fingernails, scrub behind their ears, and yes, even floss. Confident men are also less likely to suffer from performance problems in the bedroom. ***Choose one:*** (a) Confounder b) Causal Link c) Neither

confidence → floss (good hygiene)
confidence → less performance problems

14) Age: Unfortunately, erectile dysfunction is a consequence of aging; past the age of 40, the older men are, the more likely they are to acquire this condition whether they floss or not. ***Choose one:*** a) Confounder b) Causal Link (c) Neither

15) Bacterial Buildup: Without flossing, bacterial colonies can buildup in the mouth and eventually enter the bloodstream. Once circulating the body, these bacteria can damage the blood vessels of the heart, brain, and penis. These damaged blood vessels can prevent an erection from developing. ***Choose one:*** a) Confounder (b) Causal Link c) Neither explains how not flossing causes erectile dysfunction

16) Which conclusion is best based on the results of this study?
- a) This study is very strong evidence that flossing regularly ***causes*** less erectile dysfunction.
- b) This study shows that if men floss regularly, they will never develop erectile dysfunction.
- c) This study shows that flossing regularly is associated with less erectile dysfunction, but flossing ***definitely does NOT cause*** less erectile dysfunction.
- (d) This study shows that flossing regularly is ***associated with and may cause*** less erectile dysfunction.

The next 3 questions pertain to this study:
Do people work harder at boring, monotonous tasks if they think the work they're doing is meaningful? To find out, researchers hired 2,471 workers to all do the same low paid, tedious task of searching through hundreds of computers slides looking for objects that fit a particular description. The workers were **randomly** assigned to 2 groups—"meaningful" and "no context". Both groups were assigned the same exact task and trained the same way, but those in the "meaningful" group were told their work was important because they were searching for cancerous tumors, while those in the "no context" group were not told anything about how their work would be used. Those in the "meaningful" group *performed significantly better* both in terms of speed and accuracy.

17) Which of the following statements is best? ***Choose one:***
- (a) This was a randomized controlled experiment. randomly assigned!
- b) This was an observational study.
- c) This was a non-randomized controlled experiment.

18) Which of the following statements is best? ***Choose one:***
- (a) This study is strong evidence that people perform better at boring tasks if they're told the work is meaningful.
- b) This study may have cause and effect reversed. It's more likely that hard workers are able to find meaning in their work no matter how tedious the job. They have pride in the work itself and don't need to be told the work is important to do a good job.
- c) This study shows an ***association*** between belief in the importance of the work and the quality of performance, but it does not show that the belief is ***causing*** the higher performance. There are many other factors to consider, such as the individual worker's social and economic situation as well as the conditions of the work environment.

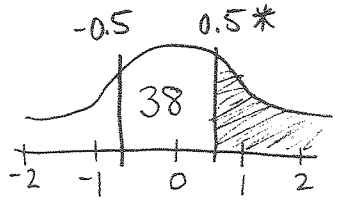
19) Which of the following are likely to confound the results? ***Choose one:***
- a) Income- if you need the money you're more likely to work harder even at very boring tasks.
- b) Computer Habits- the more time you spend in front of a computer screen the more likely you'll be to find and identify objects shown on the computer screen.
- c) Work Ethic —Those with a strong work ethic are both more likely to find meaning in their work and more likely to do work quickly and accurately.
- d) All of the above are likely confounders.
- (e) None of the above are likely confounders because there were no systematic differences between the 2 groups except for what they were told about their job. random assignment eliminates confounders!

The next 3 questions pertain to the following:
One of the survey questions this semester was: "What is the fastest you've ever driven (in mph)?' 994 people responded. The speeds are **normally distributed** with an **average = 90 mph and a SD=20 mph (Use the normal table at the end of this exam to answer these questions.)**

20) About what percentage of the students have driven over 100 mph?

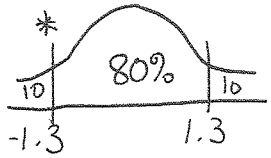
a) 16%
b) 22.5%
c) 31%
d) 40%

$Z = \frac{\text{val-ave}}{SD} = \frac{100-90}{20} = \frac{10}{20} = 0.5$



21) What speed corresponds to the 10th percentile? (10th percentile means faster than only 10% of the students.) $\frac{100-38}{2} = \frac{62}{2} = 31\%$

a) 50
b) 54
c) 59
d) 64
e) 69



10< 50 negative z

value = ave + z x SD = 90 + (-1.3)(20) = 64

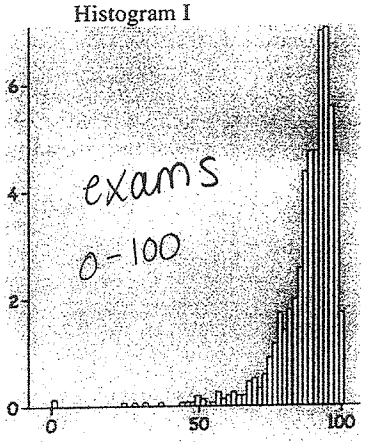
22) About 68% of the students have driven between _____ and _____ mph. 68% middle area ⇒ z-scores ± 1

a) 60 and 100
b) 65 and 105
c) 70 and 110
d) 75 and 115
e) 85 and 125

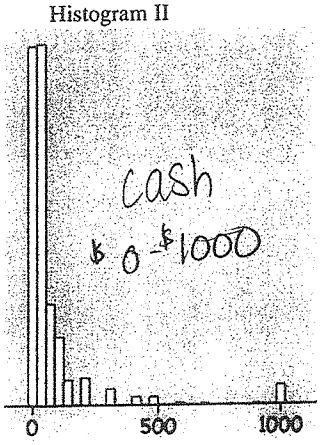
value = ave + z x SD
value = 90 + (-1)(20) = 70
value = 90 + 1(20) = 110

The next 2 questions pertain to the 3 histograms below. Two represent our survey responses to the 2 questions:
Pets: "What is the total number of dogs and cats you owned in your life?" and **Cash:** "How many dollars do you have on hand right now?"
The third represents exam scores from a previous Stat 100 exam.

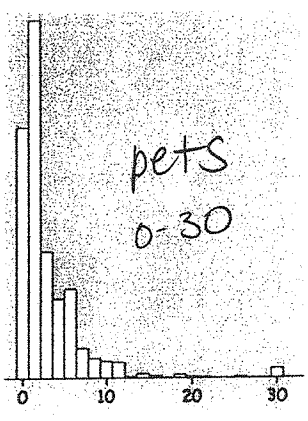
Histogram I



Histogram II



Histogram III



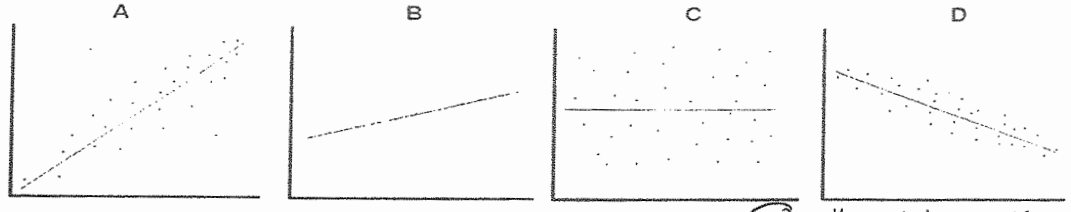
23) Match the histograms to their descriptions:

a) Histogram I represents pets; Histogram II represents cash; Histogram III represents exam scores.
b) Histogram I represents exam scores; Histogram II represents pets; Histogram III represents cash
c) Histogram I represents cash; Histogram II represents pets; Histogram III represents exam scores.
d) Histogram I represents exam scores; Histogram II represents cash; Histogram III represents pets.
e) Not enough info to know which histogram is which.

24) Which histogram(s) has an average less than the median? long left hand tail

a) Only Histogram I
b) Only Histogram II
c) Only Histogram III
d) Both Histogram II and III

For the next 3 questions match the scatter plots with their corresponding correlation coefficients; (The 4 correlation coefficients match the 4 plots, but I only ask you to match 3 of them.)



25) Plot B a) -0.7 b) 0 c) 0.6 (d) 1) all points on line

26) Plot C a) -0.7 (b) 0) c) 0.6 d) 1

27) Plot D (a) -0.7) b) 0 c) 0.6 d) 1 negative

Questions 28-30 (Assume scatter plots are football-shaped.)
Suppose measures of flexibility and strength follow the normal curve but have different correlations among different populations of athletes. Consider 3 populations where the correlation coefficient between the athletes' strength and flexibility are as given in the table below. If the athlete is in the 40th percentile in strength, estimate his percentile in flexibility.

Strength Percentile	r	Flexibility Percentile
28) 40th exactly equal	1	(a) 40th b) 44th c) 50th d) 56th e) 60th
29) 40th	0.6	a) 40th (b) 44th) c) 50th d) 56th e) 60th
30) 40th exactly opposite	-1	a) 40th b) 44th c) 50th d) 56th (e) 60th)

Questions 31-35 (Assume scatter plots are football-shaped.)
Assume that ACT (Math) and SAT (Math) scores are correlated with r = 0.8, and have the following summary statistics

	Average	SD
ACT	21	5
SAT	500	100
Correlation	r = 0.8	

val = 500 + (1.6)(100)

val = 500 + (-0.8)(100)

In the table below you're given the ACT scores of 2 students. For each student circle the regression estimate for the SAT.

ACT Score (Hint: change to Z score)	r	Regression Estimate for the SAT
31) 31 $Z = \frac{31-21}{5} = 2$	0.8 = 1.6	a) 580 b) 590 c) 620 (d) 660) e) 680
32) 16 $Z = \frac{16-21}{5} = -1$	0.8 = -0.8	a) 400 b) 410 (c) 420) d) 440 e) 496

33) What is the slope of the regression equation for predicting SATs from ACT?

$m = r \times \frac{SD_y}{SD_x} = 0.8\left(\frac{100}{5}\right) = 16$

(a) 16) b) 18 c) 12 d) 0.8 e) 0.04

34) The SD of the prediction errors (same as the RMSE) when predicting SATs from ACTs is …

a) 20 b) 36 c) 43.6 d) 80 (e) 60)

$RMSE = \sqrt{1-r^2} \times SD_y = \sqrt{1-0.8^2} \times 100 = 60$

35) The regression equation for predicting ACT scores from SAT's is: ACT= 0.04 (SAT) + _____. Fill in the blank with the correct y-intercept.

plug in the 2 averages

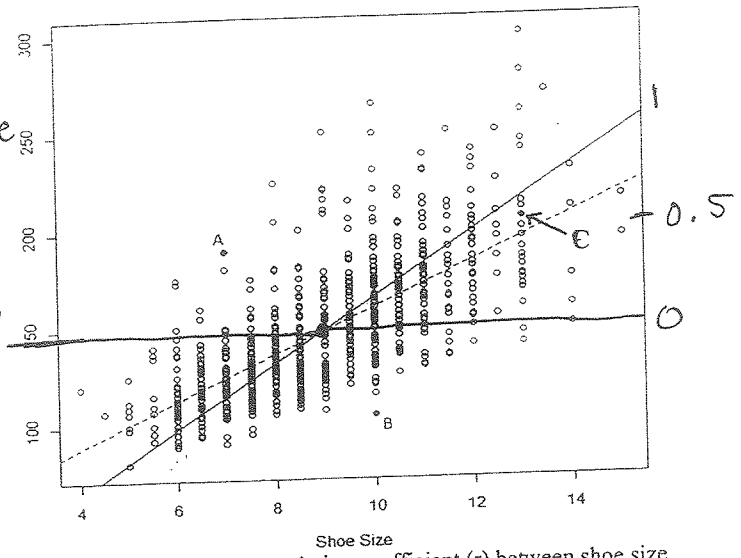
a) 18 b) 17 c) -1.5 d) 6 (e) 1)

$21 = 0.04(500) + b$

$21 = 20 + b$

$b = 1$

Questions 36-41 pertain to the scatter plot below.
The scatter plot below depicts the shoe size on the X axis and the weight (in lbs.) on the Y axis of the 1055 STAT 100 students who answered survey 1 this semester.



36) The two lines on the plot represent the SD line and the regression line. Which is the regression line?
a) Solid Line (b) Dashed Line flatter line

37) The correlation (r) between shoe size and weight is closest to: a) -0.65 b) 0.95 c) 0.2 (d) 0.7

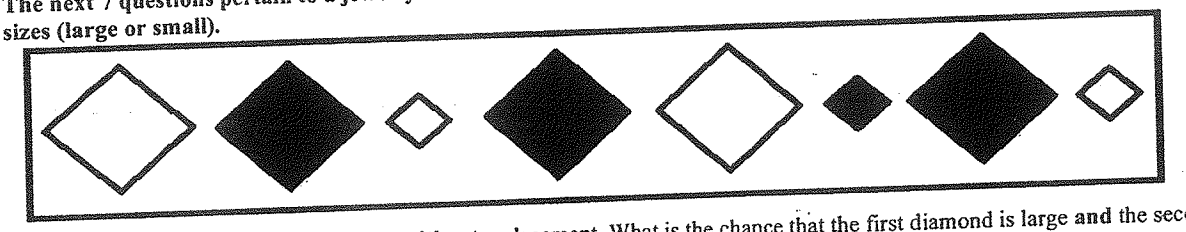
38) The mean weight is closest to:
(a) 147 b) 178 c) 110 d) 213

39) If a student is exactly 1 SD below average in both shoe size and weight, which line does he fall on?
(a) SD line only b) Regression line only c) Both lines
$z_x = z_y = -1$

40) If a new scatter plot were drawn with weight measured in kilograms (2.2 lbs/kg) the correlation coefficient (r) between shoe size and weight would: **Choose One:** a) increase b) decrease (c) stay the same

41) Look at Points A, B and C. Which have positive prediction errors? a) Only A b) Only B c) Only C (d) A and C e) B and C
points above reg line

The next 7 questions pertain to a jewelry box containing 8 diamonds of two different colors (black or white) in two different sizes (large or small).



42) Two diamonds are picked at random **without** replacement. What is the chance that the first diamond is large **and** the second diamond is small?
a) 5/8 x 5/8 b) 5/8 x 3/8 c) 5/8 x 2/7 (d) 5/8 x 3/7 e) 5/8 + 3/7
$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

43) Two diamonds are picked at random **with** replacement. What is the chance that the first diamond is large **or** the second diamond is white?
a) 5/8 x 4/8 b) 5/8 x 4/7 c) 5/8 + 4/8 d) 5/8 + 4/8 + 5/8 x 4/8 (e) 5/8 + 4/8 – 5/8 x 4/8

44) What is the chance of getting a white diamond if you *only select* from the large diamonds?
a) 5/8 x 5/8 b) 5/8 + 4/8 c) 2/3 d) 2/4 (e) 2/5

45) What is the chance of getting a large diamond if you *only select* from the white diamonds?
a) 2/5 (b) 2/4 c) 2/3 d) 5/8 + 4/8 e) 5/8 x 5/8
$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

46) One diamond is selected. What is the chance that it is **either** black or small?
a) 1/8 b) 4/8 x 3/8 c) 4/8 + 3/8 (d) 4/8 + 3/8 – 1/8 e) 4/8 x 3/8–1/8

47) Three diamonds are randomly selected **with** replacement. What is the chance that **all** three diamonds are small?
a) 3/8 +3/8 +3/8 b) $(5/8)^3$ (c) $(3/8)^3$ d) 1- $(5/8)^3$ e) 1- $(3/8)^3$

48) Three diamonds are randomly selected **with** replacement. What is the chance that **not all** three diamonds are small?
a) 5/8+5/8+5/8 b) $(5/8)^3$ c) $(3/8)^3$ d) 1- $(5/8)^3$ (e) 1- $(3/8)^3$
$P(\text{not all}) = 1 - P(\text{all})$

The next 2 questions refer to the following scenario:

On post-apocalyptic earth, a Zombie Virus has overrun the population. Once infected, it takes several days for the symptoms of Zombie Virus to set-in. In an attempt to control the outbreak, the government synthesized a diagnostic blood test to determine if a human is infected with the Virus before they display Zombie symptoms. 72% of people truly have the Zombie Virus. If someone is infected, there is a 70% chance they will correctly test positive and be hospitalized. If someone is not infected, there is a 10% chance they will falsely test positive and be hospitalized.

	Test Positive	Test Negative	Total
Infected	$0.7(720) = 504$	216	**720**
Not Infected	$0.1(280) = 28$	252	**280**
Total	**532**	**468**	**1000**

Fill in the four missing cells to answer the following 2 questions:

49) Suppose you test positive. What is the chance you do not have the virus?

a) 504/532 b) 28/280 c) 216/468 **d) 28/532** e) 504/720

50) Suppose you test negative. What is the chance you still are truly infected?

a) 504/532 b) 28/280 **c) 216/468** d) 28/532 e) 504/720

The next 2 questions pertain to tossing a fair coin repeatedly.

51) In 16 tosses of a fair coin you'd expect 8 heads, give or take _____ heads. (Fill in the blank with SE_{sum})

Box for fair coin: [1] [0], SD = 0.5

a) 0.5 b) 1 c) 1.5 **d) 2** e) 2.5 $SE_{sum} = SD \cdot \sqrt{n} = 0.5\sqrt{16} = 2$

52) If you tossed the coin **1600** times instead of 16, how would you change the answer you gave above for the SE_{sum}?

(HINT: 1600 = 100 x 16) n increases by a factor of 100 $\Rightarrow$ SEsum increases by a factor of $\sqrt{100} = 10$

a) Multiply it by 4 **b) Multiply it by 10** c) Keep it the same d) Divide it by 4 e) Divide it by 10

The next 4 questions pertain to the following situation:

A 100-question multiple-choice exam where each question has 5 choices, only one of which is correct. 4 points are awarded for the correct answer but 1 point is **deducted** for each incorrect answer.

ave $= \frac{-1(4)+4}{5} = \frac{0}{5} = 0$

Box A	Box B	Box C	Box D	Box E
[-1] [-1] [-1] [-1] [5]	[0] [0] [0] [0] [4]	[1] [1] [1] [1] [4]	[-1] [-1] [-1] [-1] [4]	[1] [0] [0] [0] [0]

53) Suppose a student guesses at random on each question and his score is computed, what is the corresponding box model?

a) Box A b) Box B c) Box C **d) Box D** e) Box E 4 pts correct, −1 pt incorrect

54) How many draws do we make from the box above?

a) 4 b) 5 c) 25 **d) 100** e) 400

55) The expected value for the student's score is …

a) 0 b) 10 c) 20 d) 40 e) 50 $EV_{sum} = n \times$ ave of box $= 100 \times 0 = 0$

56) Which Box has the smallest SD and which Box has the largest SD?

a) Box A has the smallest SD and Box B has the largest SD.
b) Box A has the smallest SD and Box C has the largest SD.
c) Box A has the smallest SD and Box E has the largest SD.
d) Box E has the smallest SD and Box A has the largest SD.
e) Box E has the smallest SD and Box C has the largest SD.

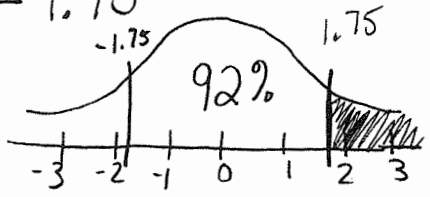
$E = \sqrt{1/5 \times 4/5}$

$A = |-1-5|\sqrt{1/5 \times 4/5}$

57) Now suppose you're just interested in how many correct answers the student would get by guessing, not his score. Then the **EV = 20 and the SE = 4. Suppose the student needs to get 27 answers correct in order to pass. What's the probability the student will pass if he guesses on all the questions? (Hint: convert to a Z score, and use the normal curve. Round percents given in the table to the nearest whole number).**

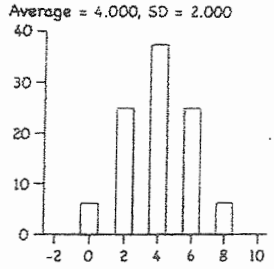
a) 1% b) 2.5% **c) 4%** d) 10.5% e) 21%

$Z = \frac{27-20}{4} = \frac{7}{4} = 1.75$

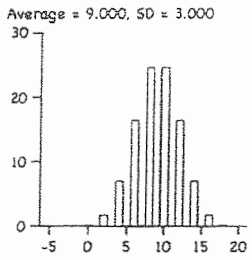


The next 3 questions pertain to the following:

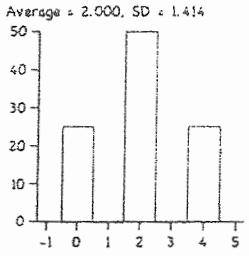
The histograms below (in scrambled order) depict the sums of 2, 4, and 9 draws from the same box. Match the number of draws to the histogram.



Histogram 1



Histogram 2



Histogram 3

58) Histogram 1 is the probability histogram for how many draws?

a) 2 (b) 4 c) 9

59) Histogram 3 is the probability histogram for how many draws?

least amount of bars ⇒ least amount of draws

(a) 2 b) 4 c) 9

60) The 3 histograms above represent the sum of 2, 4, and 9 draws from the same box. Which of these boxes is it?

a) **Box A** [0] [2] ave = 1 b) **Box B** [0] [1] [2] ave = 1 c) **Box C** ~~[0] [1] [4]~~ ave = 5/3

The next 5 questions pertain to the following 2 polls:

During the first week of December, two polls asked the same question: "Do you think decorated trees that are publicly displayed should be called "Christmas Trees" or "Holiday Trees"?" The Clarus Research Group poll asked that question of a ***randomly*** selected sample of 1,100 US adults nationwide, and the Gretawire Poll simply posted the question on its website http://gretawire.foxnewsinsider.com and allowed anyone who visited the website to cast a vote. Here are the results:

	"Christmas Trees"	"Holiday Trees"	Don't Know/Unsure	Sample Size
Clarus	80%	12%	8%	1,100
Gretawire Poll	99.5%	0.5%	0%	5,363

61) Which poll better represents how all US adults would answer this question?

a) Clarus Poll, because the Greatwire poll has too many responders that could artificially make very small results significant.

(b) Clarus Poll, because it was a randomly selected from all US adults, whereas the Greatwire poll was self-selected.

c) Gretawire Poll, because the sample size is about 5 times bigger.

d) The two polls will have about the same degree of accuracy because the advantages and disadvantages of each will balance out. The advantage of large size is offset by the disadvantage of selection bias for one poll while the advantage of random selection is offset by the disadvantage of small size for the other.

$SE_{\%} = \frac{SD}{\sqrt{n}} \times 100$

62) What is the SE for the sample percent who answered "Christmas Trees" in the Clarus poll. (Combine the other 2 groups into one.)

(a) $\frac{\sqrt{0.8 \times 0.2}}{\sqrt{1100}} \times 100\%$ b) $\frac{\sqrt{0.8 \times 0.12 \times 0.08}}{\sqrt{1100}} \times 100\%$ c) $\sqrt{0.8 \times 0.2} \times \sqrt{1100}$ d) $\frac{\sqrt{0.8 \times 0.12}}{\sqrt{1100}} \times 100\%$ e) Not possible to compute a SE

95% CI = sample % ± 2SE%

63) A 95% confidence interval for the % of all American adults who would answer "Christmas Trees" to this question is closest to

a) 77%-83% b) 78%-80% (c) 77.6%-82.4% d) Not possible to compute a confidence interval

64) A 95% confidence interval for the % of all American Jews who would answer "Christmas Trees" to this question is closest to

a) 77%-83% b) 78%-80% c) 77.6%-82.4% (d) Not possible to compute a confidence interval

↓ subgroup

The next 4 questions pertain to the following poll:
A CBS News poll asked a nation- wide random sample of 1,000 adults the question: "Do you think the federal minimum wage should be raised above the current rate of $7.25 an hour?" 69% answered "Yes" and 31% answered "No"

65) What most closely resembles the relevant box model?
a) It has 1,000 tickets, 69% are marked "1" and 31% are marked "0"
b) It has 1,000 tickets marked with dollar amounts ranging from $0.00 to $12.00.
c) It has millions of tickets. 69% are marked "1" and 31% are marked "0".
d) It has millions of tickets marked 1 and 0, but the exact amounts are unknown and estimated from our sample to be 69% and 31% respectively.

66) Which one of the statements below is true? EV% = percent of Yes's in box
a) The expected value for the % of all US minimum wage workers who would answer "Yes" to the question is 69%.
b) The expected value for the % of all US adults who would answer "Yes" to the question is 69%.
c) The expected value for the % of all US business executives would answer "No" to the question is 31%.
d) All of the above are true.
e) None of the above are true.

67) Is it possible to compute a 95% confidence interval for the percent of all US adults who would answer "Yes" to the question?
a) Yes, a 95% confidence interval is approximately 69% +/- 3%
b) Yes, a 95% confidence interval is approximately 69% +/- 0.46%
c) No, because we're not given the SD of the sample.
d) No. The responses do not follow a normal distribution.

$69 \pm \frac{\sqrt{.69 \times .31}}{\sqrt{1000}} \times 100$

69 ± 3

68) If the sample size was multiplied by 9 (from 1000 to 9000) then the SE of the sample percent and the width of the confidence interval would be ... a) multiplied by 9 b) multiplied by 3 c) divided by 9 d) divided by 3 e) Not changed

The next 6 questions pertain to the following situation:
My 3-year old niece, Mary Anne, is a football genius! In the 2012 season, I asked Mary Anne to predict whether the Chicago Bears would win or lose before each game. Out of the16 regular season games, Mary Anne had correctly predicted the outcome of 10 games. You, as a statistician, are skeptical and decide to test the Null Hypothesis that Mary Anne is just guessing.

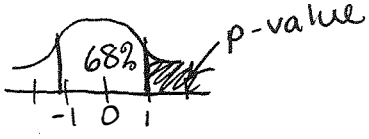
69) What is in the Null Box?
a) 16 tickets: 10 marked "1" and 6 marked "0"
b) 2 tickets: 1 marked "1" and 1 marked "-1"
c) 16 tickets: 8 marked "1" and 8 marked "-1"
d) 2 tickets: 1 marked "1" and 1 marked "0". 1 = win 0 = loss
e) 2 tickets: 1 marked "10" and 1 marked "-6"

70) The ___ draws are made ___ replacement.
a) 16; with b) 16; without c) 10; with d) 10; without e) 2; without

71) If the null hypothesis is true, how many games do you expect Mary Anne to correctly guess?
a) 10 b) 9 c) 7 d) 6 e) 8

72) What Standard Error should be calculated?
a) SE of the Sum
b) SE of the Average
c) SE of the Percent
d) No SE is needed- just SD of Prediction Errors (RMSE)
e) No SE is needed- just SD

73) The z-statistic is 1. What is the p-value?
a) 6.5% b) 16% c) 8% d) 10% e) 31%



74) What is the best conclusion?
a) Reject the null, if Mary Anne was just guessing the chance that she'd correctly predict so many games is extremely small.
b) We cannot reject the null, it's quite reasonable to believe that Mary Ann was just guessing. p > 5%
c) We can accept the null since we've proven that Mary Ann was guessing.
d) Reject the null, we've proven that Mary Anne is a football genius!

Question 75
A polling organization conducts a statewide random poll of 1000 Vermont adults to estimate the percentage of adults in Vermont who favor stricter gun control laws. They want to conduct the same poll in Michigan where the population is 16 times larger. How many people do they need to poll in Michigan to keep about the same level of accuracy as the Vermont poll?
a) 250 b) 1000 c) 4000 d) 16,000 e) 256,000 Keep n the same!

The next 5 questions pertain to the following survey:
On Bonus Survey 4 you were randomly given one of 2 questions:
"What are your feelings toward Obamacare?" or "What are your feelings toward the Affordable Care Act?
425 students randomly got the Obamacare question and 416 randomly got the Affordable Care Act question.
Your responses were coded as ratings on a scale from 1 to 5, with 1 being "very negative" and 5 being "very positive".
Here are the results:

Question	Average rating	SD	n
Obamacare	3.009	1.146	425
Affordable Care Act	3.243	1.008	416

76) What null hypothesis is best?
a) The difference between 425 and 416 is just due to chance and reflects no difference due to question wording.
b) The difference between the actual content of the 2 health care plans is just due to chance variation and reflects no difference due to question wording.
c) The difference between 3.009 and 3.243 is just due to chance and reflects no difference due to question wording.
d) The differences in responses are just due to careless errors in calculations and reflect no actual numerical differences between the 2 groups.

77) What alternative hypothesis is best?
a) The difference in responses is too large to be due to careless calculation errors and must reflect the actual differences we obtained in the survey responses.
b) The differences occurring in all 3 categories present overwhelming evidence that the questions were not randomly assigned as claimed.
c) The difference in responses is too large to be due to chance and reflects no attempt to either positively or negatively influence student reactions to government sponsored changes in our health care system.
d) The difference in responses is too large to be due to random variaton and must reflect a difference due to the different reactions people have to the words "Obamacare" vs "Affordable Care Act".

78) The SE for the Obamacare sample average is 0.06 (rounded) and the SE for the Affordable Care Act sample average is 0.05 (rounded), what is the SE for the difference of the 2 sample averages?
a) 0.11 b) 0.01 c) 0.055 d) 0.0061 e) 0.078 $SE_{diff} = \sqrt{0.06^2 + 0.05^2}$

79) The Z statistic for testing the null hypothesis is 3. (It could be positive or negative 3, it doesn't matter.) What is the p-value?
a) 99.73% b) 0.135% c) 23.58% d) 38.21% e) 3%

80) During the same week as our Bonus Survey 4, CNBC conducted a random poll of 812 adults nationwide asking the same exact 2 questions. 411 were randomly given the Obamacare question and 401 were randomly given the Affordable Care Act questions. Here are the results:

Question	Average rating	SD	n
Obamacare	2.62	1.23	411
Affordable Care Act	2.81	1.1	401

random is best!

Which poll more accurately reflects how **all US adults** would respond to these 2 questions?
a) The CNBC poll since the respondents were randomly chosen from all US adults.
b) Our Bonus Survey since our SE's for the sample averages are smaller indicating a more accurate survey.
c) The 2 polls are about equal since the advantage of the smaller SE's in our Bonus Survey is about equal to the advantage of the nationwide range of the CNBC poll.

The next 6 questions refer to the following situation:
Suppose the manufacturer of Trail Mix claims to produce 20% Almonds, 15% Raisins, 40% M&Ms, and 25% Peanuts. The ingredients are mixed up in huge vats and then randomly selected to fill bags of 200. The manufacturer claims that any differences observed in the percent composition of individual bags are just due to chance variation. To test this claim, I purchased a bag of Trail Mix and documented its contents.
Here are the results:

Ingredient	Percents Claimed by Manufacturer	*Observed #*	*Expected #*	*Obs -Exp*	*(Obs-Exp)²*	$\frac{(Obs-Exp)^2}{Exp}$
Almonds	20%	56	(.2)(200)=40	16	256	6.4
Raisins	15%	42	(.15)(200)=30	12	144	4.8
M&Ms	40%	58	(.4)(200)=80	-22	484	6.05
Peanuts	25%	44	(.25)(200)=50	-6	36	0.72
Total	100%	200	200	0		17.97

81) To test the null hypothesis that our observed data fits a random draw from the content percentages claimed by the company we'd perform…
- a) the one-sample z test
- b) the two-sample z test
- c) the chi-square test for "goodness -of-fit"
- d) the chi-square test for independence

one variable (ingredient) with 4 categories

82) The table above is missing all 4 expected numbers, which of the following is the missing column?

a)	b)	c)	d)
50	40	50	60
20	30	50	20
70	80	50	90
60	50	50	30

83) The value for Peanuts is missing in the ***Obs –Exp*** column, fill in the missing blank.

a) -6 b) 0 c) 6 d) not enough information to determine

84) To compute the proper test statistic you'd have to sum the 4 values in the last column. The test statistic is closest to

a) 2.70 b) 4.80 c) 12.75 d) 17.97 e) 23.10

85) The number of degrees of freedom is

a) 2 b) 3 c) 4 d) 5 e) 6

# of categories -1
4 - 1 = 3

86) What is the p-value?
- a) < 1%
- b) between 1% and 5%
- c) between 5% and 10%
- d) between 10% and 30%
- e) between 30% and 50%

87) Suppose the manufacturer's claim is different than above. Instead the company claims that each bag of Trail Mix contains exactly 20% Almonds, 15% Raisins, 40% M&Ms and 25% Peanuts because the company makes sure to count out exactly the correct amount of ingredients in each of their bags. To test this claim we'd perform a …

- a) chi-square test for "goodness-of-fit" since we'd still have one sample with multiple categories.
- b) chi-square test for independence since we'd have to compare 2 bags to test their claim.
- c) one-sample z test since the contents of the box is known exactly.
- d) two-sample z test since both the contents of the box and our sample are known exactly.
- e) None of the above since the situation cannot be translated into a box model so no significance test is appropriate.

The next 6 questions pertain to a Stat 100 survey question:
Last semester I asked the survey question: "Do you think it would be a good idea to break our big Lincoln Hall Stat 100 lectures into smaller sections of about 200 each?"
Here are the (rounded) results in percentages:

	No	Maybe	Yes	Total
Female	24%	41%	35%	100%
Male	35%	34%	31%	100%

Here are the same results as frequencies (or counts):

	No	Maybe	Yes	Total
Female	122	210	182	514
Male	83	82	74	239
Total	205	292	256	753

88) To test the null hypothesis that Stat 100 students' responses to this question are independent of whether they're male or female, we need to calculate the sum of the (observed-expected)^2/expected. Should we use the observed percentages from the top table or the observed frequencies from the above table in that calculation?

a) We should use the percentages (b) We should use the frequencies c) We can use either

always!

89) How many degrees of freedom are there for this test? (# of rows − 1)(# of columns − 1)

a) 1 (b) 2 c) 3 d) 4 e) 5

$(2-1)(3-1) = 1 \times 2 = 2$

90) Assuming the null hypothesis is true, what is the expected number of males who would answer "No"?

row total × column total / overall total

a) $\frac{239 \times 205}{753}$ b) $\frac{514 \times 205}{753}$ c) $\frac{239 \times 292}{753}$ d) $\frac{514 \times 256}{753}$ e) $\frac{239 \times 256}{753}$

91) The chi square statistic is the sum of 6 terms: ___ + ____ + _____ + _____ + 1.23 + 0.65 The 2 terms that are given correspond to the male "Maybe" and male "Yes" responses. The four missing terms are below. Which one corresponds to the male "No" responses?
Your answer may be off a bit due to rounding, so choose the closest one.

a) 4.94 b) 0.574 c) 0.301 d) 2.29

$\frac{(83-65)^2}{65}$

92) The chi-square statistic is 9.985. What do you conclude?

a) Reject the null and conclude that the data supports the conclusion that Stat 100 students' feelings about breaking the class into smaller sections does depend systematically on whether they're male or female.

b) Cannot reject the null, it's plausible that how Stat 100 students feel about breaking the class into smaller sections may not depend systematically on whether they are male or female.

c) Since Stat 100 students' preferences depend on many variables outside the scope of this question, we cannot determine whether or not the null hypothesis would be applicable in this situation.

The next 6 questions pertain to the following situation:
Suppose the Kurig coffee maker claims to brew a 6 oz. cup of coffee in 60 seconds, but I think it actually takes more time than that. To test the coffee maker's claim, I randomly sample 16 new coffee makers and find the average time to brew is actually 64 seconds with a SD=2 seconds. (Assume brewing temperatures are normally distributed.)

93) Why is the t-test the appropriate test to use?
a) Because the sample size is small (less than 25) b) Because the SD of the population is unknown.
c) Because the SD of the sample is unknown. d) Because both (a) and (b) are true e) Because both (a) and (c) are true.

$SD^+ = \sqrt{\frac{n}{n-1}} \times SD$

94) What is SD+?
a) 2 b) $\sqrt{\frac{64}{63}} \times 2$ c) $\sqrt{\frac{60}{59}} \times 2$ d) $\sqrt{\frac{15}{16}} \times 2$ e) $\sqrt{\frac{16}{15}} \times 2$

95) If I used the t-test, how many degrees of freedom would there be?
a) 4 b) 5 c) 6 d) 15 e) 16

96) Suppose you also performed a z-test. Which statistic would be larger? t always tinier
a) The t-statistic b) The z-statistic c) The z-statistic and t-statistic would be identical.

97) What is the purpose of the t-test?
a) To determine whether the 4-second difference was important.
b) To determine what specifically caused the 4-second difference.
c) To determine whether the 4-second difference could easily be due to chance.
d) To determine if Kurig is aware of this 4-second difference.
e) All of the above.

Question 98
Suppose Professor Karle Laska and her fiancé, Steve, believe that their love is so strong that they can actually read each other's minds. To test this, we performed an experiment where Karle flipped a coin 200 times and Steve had to state whether the coin landed on heads or tails from the next room. The resulting p-value was 5.1%. Suppose we performed the same experiment on other couples claiming to be mind-readers and found another couple, Head TA Jackie Capron, and her fiancé, James, with a resulting p-value of only 4.9%. Which of the following conclusions is best?

a) A p-value of 5.1% and a p-value of 4.9% are dramatically different results since the 5% cut-off for statistical significance reflects a difference of probability far greater than the arithmetic difference of 0.2% due to the shape of the normal curve at the 5% mark.
b) The outcomes of the two experiments were very similar, and the arbitrary 5% cutoff should not be blindly accepted in all cases.
c) Experiments between different couples should never be compared because each couple has it own unique blend of strengths and weaknesses that cannot be reduced to a simple numerical percentage.
d) We can conclude that Steve was just guessing, but that Jackie and James are overwhelming likely to be mind-readers.

Question 99
Suppose the same Heads/Tails experiment that we conducted on couples in love was also conducted on **800** pairs of strangers, who are not in love and do not read each other's minds. About how many of the 800 experiments would you expect to find statistically significant evidence for love-induced mind reading, that is how many of the results would get p-values < 5%? (Note, answer *how many, not what percent.)*
a) 0.05 experiments b) 5 experiments c) 20 experiments d) 30 experiments e) 40 experiments

$800 \times 0.05 = 40$

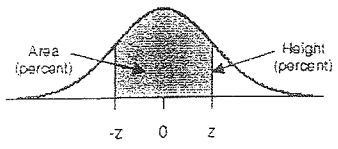
Question 100
A new food additive is tested to see if it causes cancer in lab rats. 100 rats are chosen at random and given food with the additive and 100 rats are chosen at random and given food without the additive. After 4 years the cancer rates in the 2 groups are compared. The researchers looked at 50 different types of cancer, so they did 50 different 2 sample z-tests. They found statistically significant results (p< 5%) for bone and brain cancer. Is it valid to reject the null hypothesis and conclude that the drug causes bone and brain cancer?

a) Yes, since 50 z-tests were done, the chance that bone and brain would be the only cancers to be detected is 2/50, which is 4%, less than our standard 5% cut-off for significance.
b) Yes, it doesn't matter how many tests were run because the p-value is a percent, which takes care of the number of tests run.
c) No, because if you run 50 tests, you're likely to get about 2 statistically significant results even if the null hypothesis is true, just by the luck of the draw.

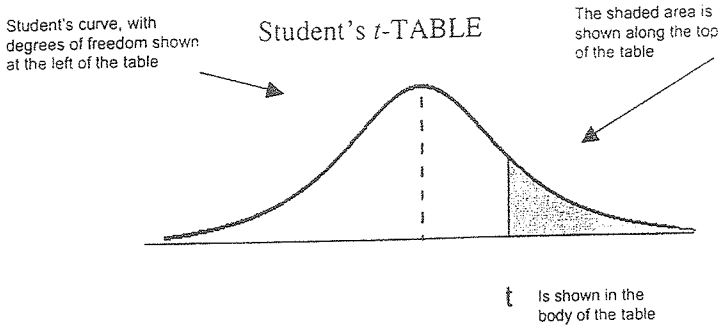
$50 \times 0.05 = 2$

Congratulations, you're now done with the Stat 100 Final! Check to make sure you filled in all 100 bubbles on your Scantron sheet. Tuck your Scantron sheet inside this booklet and bring them to the TAs in exchange for your picture ID. Then pick up your notebook and check that the student copy is signed and the instructor copy has been torn out. Bye!

STANDARD NORMAL TABLE



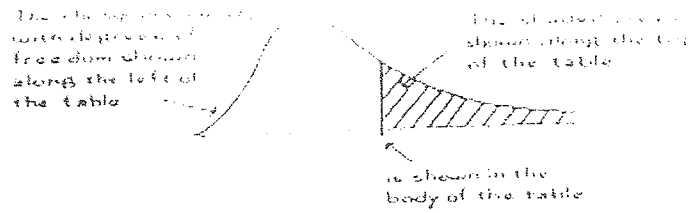
z	Height	Area	z	Height	Area	z	Height	Area
0.00	39.89	0.00	1.50	12.95	86.64	3.00	0.443	99.730
0.05	39.84	3.99	1.55	12.00	87.89	3.05	0.381	99.771
0.10	39.70	7.97	1.60	11.09	89.04	3.10	0.327	99.806
0.15	39.45	11.92	1.65	10.23	90.11	3.15	0.279	99.837
0.20	39.10	15.85	1.70	9.40	91.09	3.20	0.238	99.863
0.25	38.67	19.74	1.75	8.63	91.99	3.25	0.203	99.885
0.30	38.14	23.58	1.80	7.90	92.81	3.30	0.172	99.903
0.35	37.52	27.37	1.85	7.21	93.57	3.35	0.146	99.919
0.40	36.83	31.08	1.90	6.56	94.26	3.40	0.123	99.933
0.45	36.05	34.73	1.95	5.96	94.88	3.45	0.104	99.944
0.50	35.21	38.29	2.00	5.40	95.45	3.50	0.087	99.953
0.55	34.29	41.77	2.05	4.88	95.96	3.55	0.073	99.961
0.60	33.32	45.15	2.10	4.40	96.43	3.60	0.061	99.968
0.65	32.30	48.43	2.15	3.96	96.84	3.65	0.051	99.974
0.70	31.23	51.61	2.20	3.55	97.22	3.70	0.042	99.978
0.75	30.11	54.67	2.25	3.17	97.56	3.75	0.035	99.982
0.80	28.97	57.63	2.30	2.83	97.86	3.80	0.029	99.986
0.85	27.80	60.47	2.35	2.52	98.12	3.85	0.024	99.988
0.90	26.61	63.19	2.40	2.24	98.36	3.90	0.020	99.990
0.95	25.41	65.79	2.45	1.98	98.57	3.95	0.016	99.992
1.00	24.20	68.27	2.50	1.75	98.76	4.00	0.013	99.9937
1.05	22.99	70.63	2.55	1.54	98.92	4.05	0.011	99.9949
1.10	21.79	72.87	2.60	1.36	99.07	4.10	0.009	99.9959
1.15	20.59	74.99	2.65	1.19	99.20	4.15	0.007	99.9967
1.20	19.42	76.99	2.70	1.04	99.31	4.20	0.006	99.9973
1.25	18.26	78.87	2.75	0.91	99.40	4.25	0.005	99.9979
1.30	17.14	80.64	2.80	0.79	99.49	4.30	0.004	99.9983
1.35	16.04	82.30	2.85	0.69	99.56	4.35	0.003	99.9986
1.40	14.97	83.85	2.90	0.60	99.63	4.40	0.002	99.9989
1.45	13.94	85.29	2.95	0.51	99.68	4.45	0.002	99.9991



Degrees of freedom	*25%*	*10%*	*5%*	*2.5%*	*1%*	*0.5%*
1	1.00	3.08	6.31	12.71	31.82	63.66
2	0.82	1.89	2.92	4.30	6.96	9.92
3	0.76	1.64	2.35	3.18	4.54	5.84
4	0.74	1.53	2.13	2.78	3.75	4.60
5	0.73	1.48	2.02	2.57	3.36	4.03
6	0.72	1.44	1.94	2.45	3.14	3.71
7	0.71	1.41	1.89	2.36	3.00	3.50
8	0.71	1.40	1.86	2.31	2.90	3.36
9	0.70	1.38	1.83	2.26	2.82	3.25
10	0.70	1.37	1.81	2.23	2.76	3.17
11	0.70	1.36	1.80	2.20	2.72	3.11
12	0.70	1.36	1.78	2.18	2.68	3.05
13	0.69	1.35	1.77	2.16	2.65	3.01
14	0.69	1.35	1.76	2.14	2.62	2.98
15	0.69	1.34	1.75	2.13	2.60	2.95
16	0.69	1.34	1.75	2.12	2.58	2.92
17	0.69	1.33	1.74	2.11	2.57	2.90
18	0.69	1.33	1.73	2.10	2.55	2.88
19	0.69	1.33	1.73	2.09	2.54	2.86
20	0.69	1.33	1.72	2.09	2.53	2.85
21	0.69	1.32	1.72	2.08	2.52	2.83
22	0.69	1.32	1.72	2.07	2.51	2.82
23	0.69	1.32	1.71	2.07	2.50	2.81
24	0.68	1.32	1.71	2.06	2.49	2.80
25	0.68	1.32	1.71	2.06	2.49	2.79

A CHI-SQUARE TABLE

A CHI-SQUARE TABLE



Degrees of freedom	*99%*	*95%*	*90%*	*70%*	*50%*	*30%*	*10%*	*5%*	*1%*
1	0.00016	0.0039	0.016	0.15	0.46	1.07	2.71	3.84	6.64
2	0.020	0.10	0.21	0.71	1.39	2.41	4.60	5.99	9.21
3	0.12	0.35	0.58	1.42	2.37	3.67	6.25	7.82	11.34
4	0.30	0.71	1.06	2.20	3.36	4.88	7.78	9.49	13.28
5	0.55	1.14	1.61	3.00	4.35	6.06	9.24	11.07	15.09
6	0.87	1.64	2.20	3.83	5.35	7.23	10.65	12.59	16.81
7	1.24	2.17	2.83	4.67	6.35	8.38	12.02	14.07	18.48
8	1.65	2.73	3.49	5.53	7.34	9.52	13.36	15.51	20.09
9	2.09	3.33	4.17	6.39	8.34	10.66	14.68	16.92	21.67
10	2.56	3.94	4.86	7.27	9.34	11.78	15.99	18.31	23.21
11	3.05	4.58	5.58	8.15	10.34	12.90	17.28	19.68	24.73
12	3.57	5.23	6.30	9.03	11.34	14.01	18.55	21.03	26.22
13	4.11	5.89	7.04	9.93	12.34	15.12	19.81	22.36	27.69
14	4.66	6.57	7.79	10.82	13.34	16.22	21.06	23.69	29.14
15	5.23	7.26	8.55	11.72	14.34	17.32	22.31	25.00	30.58
16	5.81	7.96	9.31	12.62	15.34	18.42	23.54	26.30	32.00
17	6.41	8.67	10.09	13.53	16.34	19.51	24.77	27.59	33.41
18	7.00	9.39	10.87	14.44	17.34	20.60	25.99	28.87	34.81
19	7.63	10.12	11.65	15.35	18.34	21.69	27.20	30.14	36.19
20	8.26	10.85	12.44	16.27	19.34	22.78	28.41	31.41	37.57

Source: Adapted from p. 112 of Sir R. A. Fisher, *Statistical Methods for Research Workers* (Edinburgh: Oliver & Boyd, 1958).