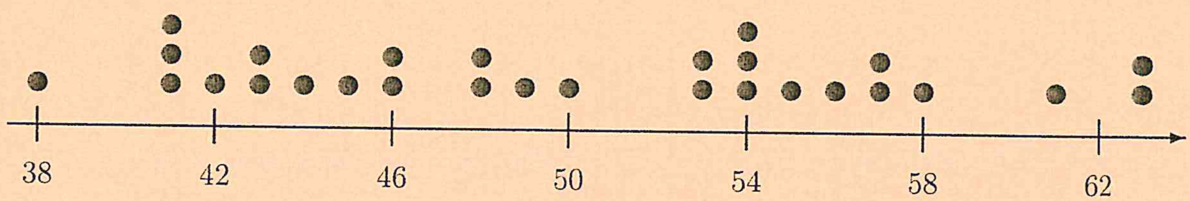
Dick Schaff Math Superbowl XLIV
Level 8 Blitz: Statistics – 2017

Directions: (1) Select the most correct answer for each question and mark it on your answer form.
(2) No calculators of any sort are allowed.
(3) Note that N.O.T. means "None of these."

1. The weights of newborn baby boys have an approximately normal distribution with a mean of 8.0 pounds and a standard deviation of 1.5 pounds. A doctor tells a mother that her newborn baby boy has a weight at the 25th percentile. Which of the following is closest to this baby's weight?

   a) 2.0 pounds   b) 5.0 pounds   c) 7.0 pounds   d) 7.63 pounds   e) N.O.T.

2. The dot plot below displays the daily high temperatures, in degrees Fahrenheit, for a Central Valley city during the 28 days in February 2017.



   Which of the following is closest to the percentile rank of a day in that month where the daily high temperature in this city was 60 degrees Fahrenheit?

   a) 10   b) 40   c) 75   d) 90   e) N.O.T.

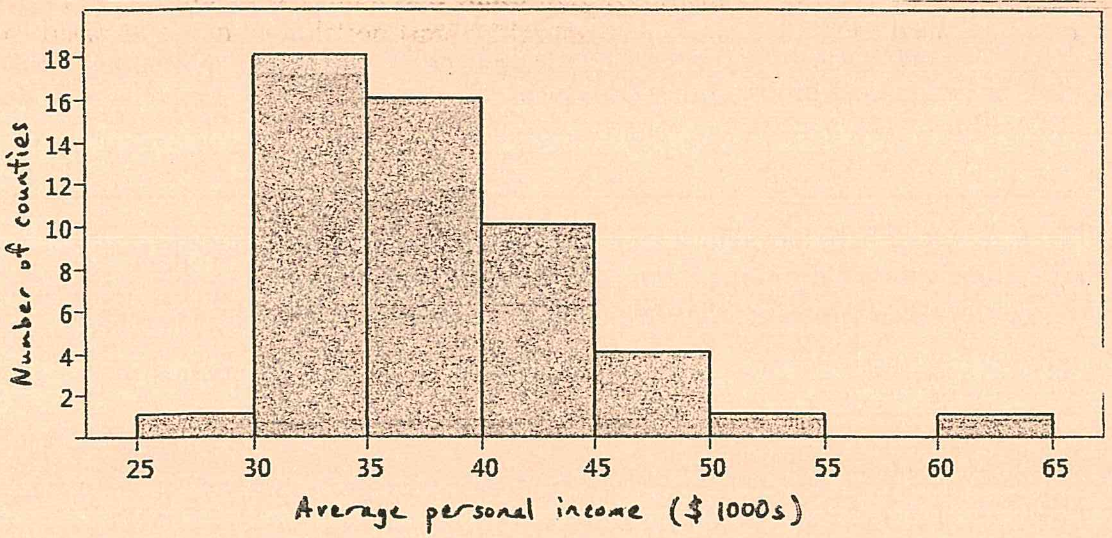
3. When manufacturing a certain tablet device, defects occur at different rates, depending on the type of defect. For this tablet, screen-related defects occur in 1% of tablets, defects related to the charging port occur in 2% of tablets, and both defects occur in 0.5% of tablets. What is the probability that a tablet has a screen-related defect, given that it has a defect related to the charging port?

   a) 0.25   b) 0.2   c) 0.03   d) 0.01   e) N.O.T.

4. Let X be a random variable that represents the speed of a randomly selected pitch in a baseball game on Opening Day. Suppose X has an approximately normal distribution with $\mu = 84$ and $P(X > 95) = 0.0139$. Which of the following changes would lead to the greatest reduction in this probability?

   a) Decrease μ to 81   b) Decrease σ to 4
   c) Increase 95 to 99   d) Change $>$ to $<$ e) N.O.T.

5. The histogram below illustrates the distribution of average personal income (in thousands of dollars) for a selection of California counties.



Which of the following best describe the shape of this distribution and the most likely relationship between the mean and median of this distribution?

a) Skewed left, and mean < median
b) Skewed left, and mean > median
c) Skewed right, and mean > median
d) Symmetric, and mean = median
c) N.O.T.

6. Suppose you toss two fair, four-sided dice whose faces are labeled 1, 2, 3, and 4, respectively. Let $\overline{X}$ represent the average of the two sides that are facing up. Which of the following tables accurately gives the sampling distribution of $\overline{X}$?

a)

$\overline{X}$	1	1.5	2	2.5	3	3.5	4
Probability	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{1}{8}$	$\frac{1}{16}$

b)

$\overline{X}$	1	1.5	2	2.5	3	3.5	4
Probability	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$

c)

$\overline{X}$	2	3	4	5	6	7	8
Probability	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{1}{8}$	$\frac{1}{16}$

d)

$\overline{X}$	2	3	4	5	6	7	8
Probability	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$

c) N.O.T.

7. Forty college students volunteered to be part of an experiment in which half were randomly assigned to a quiet room and the other half to a room in which loud music was played. Students were asked to solve an easy crossword puzzle, and their completion times were recorded. A 95% confidence interval for the difference between mean completion time with music and mean completion time with no music was found to be $(4, 12)$ minutes. Consider a null hypothesis of no difference in average completion time between these two groups. At a significance level of 0.05, can we reject the null hypothesis?

   a) Yes, because the confidence interval contains zero.
   b) Yes, because the confidence interval does not include zero.
   c) No, because the confidence interval does not include zero.
   d) No, because there is no relationship between confidence intervals and hypothesis tests.
   e) N.O.T.

8. Which of the following statistical measures always has the same value as the median of a data set of numbers?

   a) The mean
   b) The interquartile range
   c) The mode
   d) The 50th percentile
   e) N.O.T.

9. Which of the following is true about the standard normal distribution curve?

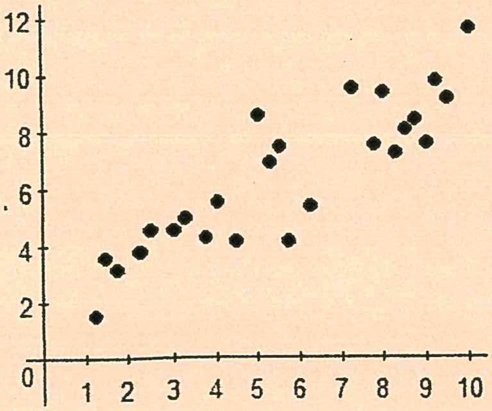
   a) The curve touches the z-axis at $z = -3$ and $z = 3$.
   b) The area under the entire is curve is 3.
   c) Approximately 95% of the area under the curve lies between $z = -3$ and $z = 3$.
   d) Approximately 68% of the area under the curve lies between $z = 0$ and $z = 1$.
   e) N.O.T.

10. The dining staff at U.C. Davis plans to survey students to get their opinion on a new nutrition program introduced this semester at each of the on-campus dining halls. They wish to obtain feedback from students living on-campus and students living off-campus about the new meal options that were introduced. Which of the following methods is the most appropriate for accomplishing this?

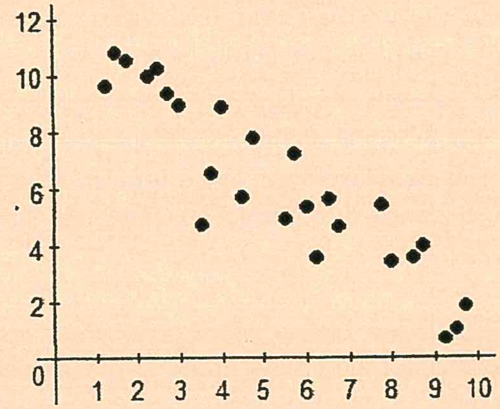
    a) Hand out a survey to every fifth student that enters each dining hall on a specified day.
    b) Group students by housing status, one group representing those living on campus and the other representing those living off campus. Send a survey to 100 randomly selected students from each group.
    c) On equally sized slips of paper, write down the names of all the dormitories on campus and all the apartment complexes off campus. Put all the names in a hat, mix the papers well, and draw out five papers. Send a survey to all students in the five randomly selected buildings.
    d) Create a Facebook page for each dining hal where students can post their comments.
    e) N.O.T.

11. Which scatter plot could represent a data set for two variables with a correlation coefficient of $r = -0.75$?

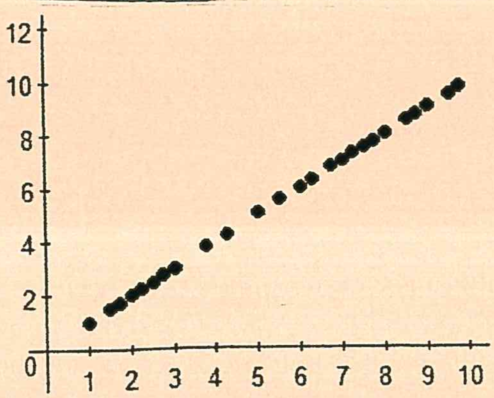
a)



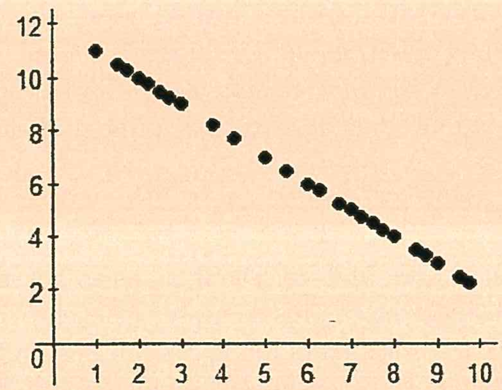
b)



c)



d)



e) N.O.T.

12. If there is sufficient evidence to reject a null hypothesis at the 10% level of significance, at which of these other levels of significance could the null hypothesis be rejected?

a) 20% b) 5% c) 1% d) No other level e) N.O.T.

13. In the design of a survey, which of the following best explains how to minimize response bias?

a) Increase the sample size.
b) Decrease the sample size.
c) Increase the number of questions in the survey.
d) Carefully word and field-test the survey questions.
e) N.O.T.

14. When comparing two sets of numerical data, which of the following statements is true?

a) If the first data set has a larger mean than the second data set, then the first data set must have a larger spread than the second data set.

b) If the first data set has a larger mean than the second data set, then the median of the first data set must be larger than the second data set.

c) If the first data set has a larger standard deviation than the second data set, then the first data set must have a larger spread than the second data set.

d) If the first data set has a larger median than the second data set, then the mean of the first data set must be larger than the second data set.

e) N.O.T.

15. A biologist is interested in predicting the brain weight (in grams) of a certain species of bird from its body weight (in grams). A least square regression line was fito to data collected from a random sample of 28 birds of this species. The equation of this line is $\hat{y} = 3.79 + 0.08x$, where $\hat{y}$ is the predicted brain weight and x is the bird's body weight. Which of the following gives the best interpretation of the slope of the regression line?

a) There is an increase of 0.08 grams in the predicted brain weight of this species of bird for every increase of 1 gram in body weight.

b) There is an increase of 0.08 grams in the predicted body weight of this species of bird for every increase of 1 gram in brain weight.

c) There is an increase of 3.79 grams in the predicted brain weight of this species of bird for every increase of 1 gram in body weight.

d) There is an increase of 3.79 grams in the predicted body weight of this species of bird for every increase of 1 gram in brain weight.

e) N.O.T.

16. To survey the opinions of students at a local high school, a researcher will select every twenty-fifth student entering the school in the morning. Assuming there are no absences, will this result in a simple random sample of students attending the school?

a) Yes, because every student has the same chance of being selected.

b) Yes if there is a single entrance to the school that all students must use.

c) Yes, because those students not selected will form a control group.

d) No, because not every sample of the intended size has an equal chance of being selected.

e) N.O.T.

17. A raffle is held for a local charity, and one thousand raffle tickets are to be sold for \$1.00 each. After all the tickets are sold, one ticket will be selected at random, and its owner will receive \$50.00. The expected value for the net gain for each ticket is $-\$0.95$. What is the meaning of the expected value in this context?

a) The ticket owners lose an average of \$0.05 per raffle ticket.

b) The ticket owners lose an average of \$0.95 per raffle ticket.

c) Each ticket owner will lose \$0.95 per raffle ticket.

d) A ticket owner has a 95 percent chance of having a ticket that is not selected.

e) N.O.T.

18. If the mean of a data set is 176.4 and the standard deviation is 0, then which of the following statements is true?

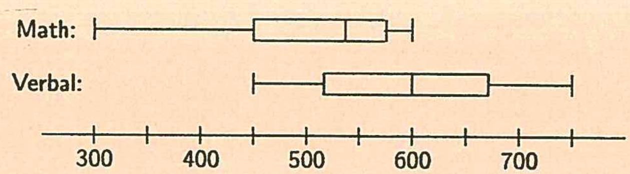
a) All of the observations are equal to 176.4.
b) A standard deviation of 0 is impossible, so a mistake must have been made in the calculation.
c) A histogram of the data set will be strongly skewed.
d) There is a large amount of variability in the data set.
e) N.O.T.

19. A random sample of 500 voters revealed that 100 are in favor of a controversial state proposition. Which of the following represents a 95% confidence interval for the proportion of the population of voters who are in favor of the proposition?

a) $100 \pm 1.96\sqrt{\frac{(0.5)(0.5)}{500}}$ b) $0.2 \pm 1.645\sqrt{\frac{(0.5)(0.5)}{500}}$

c) $100 \pm 1.645\sqrt{\frac{(0.2)(0.8)}{500}}$ d) $0.2 \pm 1.96\sqrt{\frac{(0.2)(0.8)}{500}}$ e) N.O.T.

20. The box plots below summarize the distributions of SAT verbal and math scores among students at a local school.



Which of the following statements is true?

a) The range of math scores is larger than the range of verbal scores.
b) The highest math score equals the median verbal score.
c) The first quartile of the verbal scores is larger than the median of the math scores.
d) The highest total SAT score must be 1300.
e) N.O.T.

21. Referring to the box plot in the previous problem, approximately what is the interquartile range of the math scores?

a) 120 b) 150 c) 90 d) 300 e) N.O.T.

22. The commuting time for a student to travel from home to a particular college campus is normally distributed with a mean of 20 minutes and a standard deviation of 5 minutes. If the student leaves home at 7:45 a.m., what is the probability that the commuting student will arrive at the college campus between 8:05 a.m. and 8:10 a.m.?

a) 0.16 b) 0.32 c) 0.34 d) 0.50 e) N.O.T.

23. A researcher uses a set of sample data to test the hypothesis $H_0 : \mu = 2$ versus $H_a : \mu \neq 2$, and the resulting p-value is 0.16. What can be said about the p-value if this same data were instead used to test H_0 against the alternative hypothesis $H_a : \mu < 2$?

a) The p-value must be 0.08.
b) The p-value must be 0.84.
c) The p-value must be 0.92.
d) The p-value could be 0.08 or 0.92.
e) N.O.T.

24. Data were collected on the amount, in dollars, that individual customers spent on dinner at a local restaurant. The quartiles for the data are given below.

Q1: \$13.45
Q2: \$18.20
Q3: \$20.07

Which of the following statements must be true for these customers?

a) At least half of the customers spent less than or equal to \$13.45, and at least half spent greater than or equal to \$20.07.
b) Seventy-five percent of the customers spent between \$13.45 and \$20.07.
c) The mean amount spent by the customers is \$18.20
d) Twenty-five percent of the customers spent less than or equal to \$20.07.
e) N.O.T.

25. The weight of adult male grizzly bears living in the wild in the continental United States is approximately normally distributed with a mean of 500 pounds and a standard deviation of 50 pounds. The weight of female grizzly bears is approximately normal distributed with a mean of 300 pounds and a standard deviation of 40 pounds. Approximately what would be the weight of a female grizzly bear with the same standardized score (z-score) as a male grizzly bear with a weight of 530 pounds?

a) 276 pounds
b) 324 pounds
c) 340 pounds
d) 530 pounds
e) N.O.T.

26. A doctor believes the exercise habits of East Coast adults are different from the exercise habits of West Coast adults. To study this, she gathers information on the number of hours of exercise per week from a random sample of East Coast adults and a random sample of West Coast adults. Which of the following might be an appropriate null hypothesis for this study?

a) The average number of hours of exercise per week for East Coast adults is different from the average number of hours of exercise per week for West Coast adults.
b) The average number of hours of exercise per week for East Coast adults is the same as the average number of hours of exercise per week for West Coast adults.
c) The average number of hours of exercise per week for East Coast adults is greater than the average number of hours of exercise per week for West Coast adults.
d) The average number of hours of exercise per week for East Coast adults is less than the average number of hours of exercise per week for West Coast adults.
e) N.O.T.

27. Suppose X is a binomial random variable in which $P(X = k) = \binom{15}{k}(0.29)^k(0.71)^{15-k}$ for $k = 0, 1, \ldots, 15$. What is the mean of X?

a) 0.29 b) 0.71 c) 4.35 d) 10.65 e) N.O.T.

28. For a simple random sample of size 7, what can be said about the probability that the t-variable is greater than 1.9?

a) The probability is 1.9/7.
b) The probability cannot be computed unless if we know the standard deviation for the sample.
c) The probability is between 0.025 and 0.05.
d) The probability is between 0.05 and 0.10.
e) N.O.T.

29. A large-sample 98% confidence interval for the proportion of Stanislaus County drivers that believe traffic on Highway 99 is a serious problem is (0.65,0.71). What is the sample proportion of Stanislaus County drivers that believe traffic on Highway 99 from which this interval was constructed?

a) 0.03 b) 0.06 c) 0.68
d) Cannot be determined from the given information e) N.O.T.

30. Which of the following is a criterion for choosing a t-test rather than a z-test when making an inference about the mean of a population?

a) The standard deviation of the population is unknown.
b) The mean of the population is unknown.
c) The sample may not have been a simple random sample.
d) The population is not normally distributed.
e) N.O.T.

31. According to data from the U.S. Census Bureau, in 1970 the average age of a mother at the birth of her first child was 21 years. A researcher believes the average age of first-time mothers today is substantially higher and surveys a random sample of 35 mothers to test the hypotheses $H_0 : \mu = 21$ and $H_a : \mu > 21$. In these hypotheses, what does μ represent?

a) The sample mean age of a mother at the birth of her first child in 1970.
b) The population mean age of a mother at the birth of her first child in 1970.
c) The current population mean age of a mother at the birth of her first child.
d) The mean age at the birth of their first child for the 35 mothers surveyed by this researcher.
e) N.O.T.

32. Participants in a study are asked two questions. Based on a large number of participants, the probability distribution for the responses to Questions 1 and 2 is given below.

		Question 1	
		Correct	Incorrect
Question 2	Correct	0.25	0.20
	Incorrect	0.08	0.47

For one participant, define the following events.

A = Question 1 is answered correctly.
B = Question 2 is answered correctly.

Which of the following is true?

a) A and B are independent because one participant's answers do not affect another participant's answers.
b) A and B are not independent because $(0.33)(0.45) \neq 0.25$.
c) A and B are not independent because the probability in each cell is not 0.25.
d) There is not enough information provided to determine whether A and B are independent.
e) N.O.T.

33. A recent survey randomly sampled 25 college students, asking them "How many times per day do you access a social media web site?" The average number of times reported in the sample was 8.6, with a sample standard deviation of 3.3. A 90% confidence interval for the population mean number of times per day that college students visit social media web sites is:

a) $8.6 \pm 1.96\left(\frac{3.3}{\sqrt{25}}\right)$
b) $8.6 \pm 1.645\left(\frac{3.3}{\sqrt{24}}\right)$
c) $8.6 \pm 1.711\left(\frac{3.3}{\sqrt{24}}\right)$
d) $8.6 \pm 2.064\left(\frac{3.3}{\sqrt{25}}\right)$
e) N.O.T.

34. There were 3,482 previously owned homes sold in a nearby city in the year 2010. The distribution of the sales prices of these homes was strongly left-skewed with a mean of \$243,821 and a standard deviation of \$39,882. If all possible simple random samples of size 100 are drawn from this population and the mean is computed for each of these samples, which of the following describes the sampling distribution of the sample mean?

a) Approximately normal with mean \$243,821 and standard deviation \$3,988.
b) Approximately normal with mean \$243,821 and standard deviation \$39,882.
c) Strongly left-skewed with mean \$243,821 and standard deviation \$3,988.
d) Strongly left-skewed with mean \$243,821 and standard deviation \$39,882.
e) N.O.T.

35. For two people, actuarial tables say the probability that person A will die before age 86 is 0.7, and the probability that person B will die before age 86 is 0.6. What is the probability that at least one of A and B dies before the age of 86?

a) 0.88 b) 0.60 c) 0.92 d) 0.84 e) N.O.T.

36. Which of the following can be used to show a cause-and-effect relationship between two variables?

a) A census.
b) A controlled experiment.
c) An observational study.
d) A sample survey.
e) N.O.T.

37. When using a one-sample t-procedure to construct a confidence interval for the mean of a finite population, a condition is that the population size be at least ten times the sample size. The reason for the condition is to ensure which of the following?

a) The sample size is large enough.
b) The Central Limit Theorem is applicable for the sample mean.
c) The sample standard deviation is a good approximation of the population standard deviation.
d) The degree of dependence among observations is negligible.
e) N.O.T.

38. The California Highway Patrol conducted an observational study in which drivers on Interstate 5 were observed at several places to determine if the speed limit was being followed. Of the 743 female drivers, 591 followed the speed limit. Of the 928 male drivers, 684 followed the speed limit. What significance test should be used to determine whether these data provide enough evidence to reject the hypothesis that the percentage of females following the speed limit on Interstate 5 is the same as the percentage of males following the speed limit on Interstate 5?

a) One proportion z-test
b) One sample z-test for a mean
c) Two sample z-test for means
d) Two sample t-test for means
e) N.O.T.

39. Katherine's doctor told her that the standardized score (z-score) for her systolic blood pressure, as compared to the blood pressure of other women her age, is 1.50. Which of the following is the best interpretation of this standardized score?

a) Katherine's systolic blood pressure is 150.
b) Katherine's systolic blood pressure is 1.50 times the average systolic blood pressure for women her age.
c) Katherine's systolic blood pressure is 1.50 standard deviations above the average systolic blood pressure of women her age.
d) Katherine's systolic blood pressure is 1.50 above the average systolic blood pressure of women her age.
e) N.O.T.

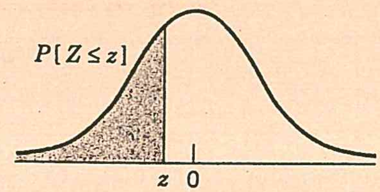
40. A company sells mulch in batches of 5 cubic yards. The probability distribution of X, the number of cubic yards of mulch sold in a single order of mulch from this company, is shown in the table.

X	10	15	20	25	30
Probability	0.15	0.25	0.25	0.30	0.05

The expected value of X is 19.25, and the standard deviation is 5.76. There is a fixed cost to deliver the mulch. The profit Y, in dollars, for a particular order can be described by the equation $Y = 75X - 100$. What is the standard deviation of Y?

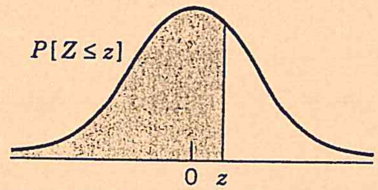
a) \$332.00 b) \$432.00 c) \$1,343.75 d) \$1,400.00 e) N.O.T.

TABLE 3 Standard Normal Probabilities



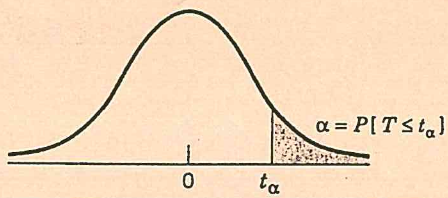
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.5	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−.7	.2420	.2389	.2358	.2327	.2297	.2266	.2236	.2206	.2177	.2148
−.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

TABLE 3 *(Continued)*



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7703	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998
3.5	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998

TABLE 4 Percentage Points of t Distributions



d.f. \ α	.25	.10	.05	.025	.01	.00833	.00625	.005
1	1.000	3.078	6.314	12.706	31.821	38.204	50.923	63.657
2	.816	1.886	2.920	4.303	6.965	7.649	8.860	9.925
3	.765	1.638	2.353	3.182	4.541	4.857	5.392	5.841
4	.741	1.533	2.132	2.776	3.747	3.961	4.315	4.604
5	.727	1.476	2.015	2.571	3.365	3.534	3.810	4.032
6	.718	1.440	1.943	2.447	3.143	3.287	3.521	3.707
7	.711	1.415	1.895	2.365	2.998	3.128	3.335	3.499
8	.706	1.397	1.860	2.306	2.896	3.016	3.206	3.355
9	.703	1.383	1.833	2.262	2.821	2.933	3.111	3.250
10	.700	1.372	1.812	2.228	2.764	2.870	3.038	3.169
11	.697	1.363	1.796	2.201	2.718	2.820	2.981	3.106
12	.695	1.356	1.782	2.179	2.681	2.779	2.934	3.055
13	.694	1.350	1.771	2.160	2.650	2.746	2.896	3.012
14	.692	1.345	1.761	2.145	2.624	2.718	2.864	2.977
15	.691	1.341	1.753	2.131	2.602	2.694	2.837	2.947
16	.690	1.337	1.746	2.120	2.583	2.673	2.813	2.921
17	.689	1.333	1.740	2.110	2.567	2.655	2.793	2.898
18	.688	1.330	1.734	2.101	2.552	2.639	2.775	2.878
19	.688	1.328	1.729	2.093	2.539	2.625	2.759	2.861
20	.687	1.325	1.725	2.086	2.528	2.613	2.744	2.845
21	.686	1.323	1.721	2.080	2.518	2.601	2.732	2.831
22	.686	1.321	1.717	2.074	2.508	2.591	2.720	2.819
23	.685	1.319	1.714	2.069	2.500	2.582	2.710	2.807
24	.685	1.318	1.711	2.064	2.492	2.574	2.700	2.797
25	.684	1.316	1.708	2.060	2.485	2.566	2.692	2.787
26	.684	1.315	1.706	2.056	2.479	2.559	2.684	2.779
27	.684	1.314	1.703	2.052	2.473	2.552	2.676	2.771
28	.683	1.313	1.701	2.048	2.467	2.546	2.669	2.763
29	.683	1.311	1.699	2.045	2.462	2.541	2.663	2.756
30	.683	1.310	1.697	2.042	2.457	2.536	2.657	2.750
40	.681	1.303	1.684	2.021	2.423	2.499	2.616	2.704
60	.679	1.296	1.671	2.000	2.390	2.463	2.575	2.660
120	.677	1.289	1.658	1.980	2.358	2.428	2.536	2.617
∞	.674	1.282	1.645	1.960	2.326	2.394	2.498	2.576