MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Provide an appropriate response.

1) A meteorologist constructs a graph showing the total precipitation in Phoenix, Arizona in each of the months of 1998. Does this involve descriptive statistics or inferential statistics?

1)

A) Descriptive

B) Inferential

Answer the question.

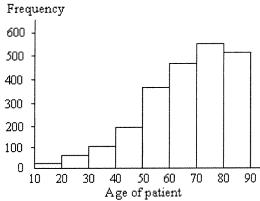
2) 100,000 randomly selected adults were asked whether they drink at least 48 oz of water each day and only 45% said yes. Identify the sample and population.

.)

- A) Sample: the 100,000 selected adults; population: the 45% of adults who drink at least 48 oz of water
- B) Sample: the 100,000 selected adults; population: all adults
- C) Sample: the 45% of adults who drink at least 48 oz of water; population: all adults
- D) Sample: all adults; population: the 100,000 selected adults

A graphical display of a data set is given. Identify the overall shape of the distribution as (roughly) bell-shaped, triangular, uniform, reverse J-shaped, J-shaped, right skewed, left skewed, bimodal, or multimodal.

3) The ages of a group of patients being treated at one hospital for osteoporosis are summarized in the frequency histogram below.



- A) Right skewed
- C) Bell-shaped

- B) Left skewed
- D) Reverse J-shaped

Classify the data as either qualitative or quantitative.

4) The following table shows the average weight of offensive linemen for each given football team. 4)

Team	Average weight (pounds)
Gators	303.52
Lakers	326.78
Eagles	290.61
Pioneers	321.96
Lions	297.35
Mustangs	302.49
Rams	345.88
Buffalos	329.24

What kind of data is provided by the information in the first column?

A) Qualitative

B) Quantitative

Classify the data as either discrete or continuous.

- 5) The number of cars passing a busy intersection between 4:30 P.M. and 6:30 P.M. on a Monday is 2,200.
- 5) __

A) Discrete

B) Continuous

Provide an appropriate response.

6) The data in the following table show the results of a survey of college students asking which vacation destination they would choose given the eight choices shown. Determine the value that should be entered in the relative frequency column for Arizona.

6)	***************************************

Destination	Frequency	Relative frequency
Florida	34	
Mexico	80	
Belize	18	
Puerto Rico	26	
Alaska	4	
California	20	
Colorado	12	
Arizona	6	
	•	•

A) 0.06

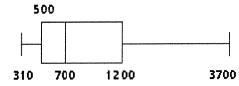
- B) 0.03
- C) 0.003
- D) 6

Construct and interpret a boxplot or a modified boxplot as specified.

7) The weekly salaries (in dollars) of 24 randomly selected employees of a company are shown below. Construct a boxplot for the data.

310	320	450	460	470	500	520	540
580	600	650	700	710	840	870	900
1000	1200	1250	1300	1400	1720	2500	3700

A)

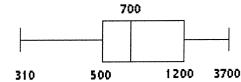


The data is highly right-skewed.

B)

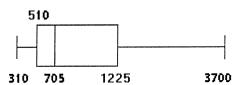
D)

310

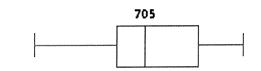


The data is fairly symmetrical.

C)



The data is highly right-skewed.



1225

3700

510 The data is fairly symmetrical.

	sample stand	lard c	levia	tion f	or the given d	ata. Round	your final an	swer to one	more decimal place	than that used
8	•		•	•	g college astror t the following	•	nstructor ofte	n gives quizz	zes. On the past	8)
	42 11 36	29	14	50	64					
	A) 36	1)	1.1	50	B) 19		C) 8645.1		D) 10,814	
	mean for the	-		ple c	lata. Unless ot	herwise spe	ecified, round	d your answe	er to one more decin	nal place than
				loyee	es earned \$326.	90, \$262.82,	\$253.23, \$254	1.01, \$352.07,	and \$209.77 last	9)
	week. Find	the m	ean v	vage	of the employe	es. Round y	our answer t	o the nearest	cent.	
	A) \$319.7	6			B) \$414.70		C) \$331.76		D) \$276.47	
)) The weights				le range as spe 17 randomly se		lts are given b	pelow. Find t	he interquartile	10)
	range.									
	144 165 1	87 1	43 1	19 1	32					
	127 156 1									
	114 146 1				-					
	A) 30 lb				B) 37.5 lb		C) 37 lb		D) 38 lb	
Use the tenth.	regression eq	uatio	n to p	redic	ct the y-value o	correspond	ng to the giv	en x-value. I	Round your answer	to the nearest
11	l) The regressi	on eq	uatio	n rela	ating attitude r	ating (x) an	d job perform	nance rating (y) for ten randomly	11)
	selected empember selected emp				npany is $\hat{y} = 11$. ting is 77.	.7 + 1.02x. P	redict the job	performance	e rating for an	
	A) 12.6				B) 80.1		C) 88.9		D) 90.2	
Provide	an appropriat	e resi	onse	e.						
	2) For the linea	ır equ	ation		3 + 6x, explain	what the y-	intercept and	l slope repres	ent in terms of the	12)
	graph of the									
	A) The y-	inter	cept,	$b_0 =$	8, gives the y-	value at wh	ich the straigl	ht line $y = 8 +$	6x intersects the	
	y-axis.	. The	slope	, b ₁ =	= 6, indicates th	at the x-va	lue increases	by 6 units for	r every increase in y	
	of 1 un									
									- 6x intersects the	
	x-axis. of 1 un		slope	, b ₁ =	= 6, indicates th	at the x-va	lue increases	by 6 units for	r every increase in y	
			cept, l	$b_0 = 8$	3, gives the y-v	alue at whi	ch the straigh	nt line $y = 8 +$	6x intersects the	
	*		slope	, b ₁ =	6, indicates th	at the y-va	lue increases	by 6 units for	r every increase in x	
	of 1 un		1			rahan e t milit	ala 4la a =4	4 line - 0 :	6x intorganta tha	
									6x intersects the	
	-		siope	, p ₁ =	o, indicates th	iat the y-va	iue increases	by 8 units for	r every increase in x	
	of 1 un	ıί.								

13) For the 14 teams in baseball regular season is 0.51 for shallowed. (mlb.mlb.com/statwins?	utouts, 0.61 for hits	made,70 for runs allow	ved and -0.56 for homeruns	13)
		P) hitamada		
A) homeruns allowed C) shutouts		B) hits made D) runs allowed		
Compute the coefficient of determina	ntion. Round vour	answer to four decimal p	laces.	
14) A regression equation is obt	· ·			14)
138.7, the regression sum of		-	*	/
A) 0.4102	B) 0.5898	C) 1.6956	D) 0.6956	
Find the indicated probability.				
15) If you flip a coin three times What is the probability of ge	-		HTT THH THT TTH TTT.	15)
	•		3	
A) $\frac{7}{8}$	B) $\frac{1}{4}$	C) $\frac{1}{2}$	D) $\frac{3}{4}$	
Find the indicated probability by usi	ng the special addi	tion rule.		
16) A percentage distribution is			.S. city.	16)
Size Percentage				
2 49.2				
3 24.2				
4 12.1				
5 9.6				
6 2.9				
7+ 2.0				
A family is selected at rando	-	pility that the size of the fa	amily is at most 3. Round	
approximations to three dec	*			
A) 0.266	B) 0.734	C) 0.492	D) 0.242	
List the outcomes comprising the spec				
17) Three board members for a r				17)
board members will be select members are Allison, Betty, follows.	-		-	
ABC ABD ABE AC	D ACE			
ADE BCD BCE BD				
Here, for example, ABC reproperties on the board. List the outcome			Charlie are selected to be	
A = event that Charlie is sele	ected			
A) CDE		B) ABC, ACD, AC	E, BCD, BCE, CDE, BDE	
C) ABC ACD ACE BCD	CDE	· · · · · · · · · · · · · · · · · · ·	E BCD BCE CDE	

Calculate the specified probability

18) Suppose that D is a random variable. Given that P(D > 0.4) = 0.45, find $P(D \le 0.4)$.

A) 0.55

B) 0

C) 0.45

D) 0.275

18) _____

Find the indicated probability or percentage for the normally distributed variable.

19) The diameters of bolts produced by a certain machine are normally distributed with a mean of 0.30 inches and a standard deviation of 0.01 inches. What percentage of bolts will have a diameter greater than 0.32 inches?

19) ____

A) 97.72%

B) 2.28%

C) 47.72%

D) 37.45%

20) The variable X is normally distributed. The mean is μ = 22.0 and the standard deviation is σ = 2.4. Find P(19.7 < X < 25.3).

20) _____

A) 0.7477

B) 0.3370

C) 1.0847

D) 0.4107

Find the specified percentile, quartile, or decile.

21) At one college, GPAs are normally distributed with a mean of 2.8 and a standard deviation of 0.5. Find the third quartile, Q_2 .

21)

A) 3.175

B) 3.135

C) 2.465

D) 3.05

Identify the distribution of the sample mean. In particular, state whether the distribution of \bar{x} is normal or approximately normal and give its mean and standard deviation.

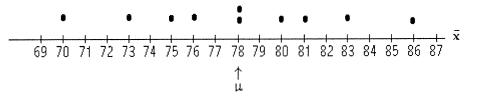
22) The weights of people in a certain population are <u>normally distributed</u> with a mean of 157 lb and a standard deviation of 24 lb. Determine the sampling distribution of the *sample* mean \bar{x} for samples of size 6. (State whether it is normal or approximately normal, and give mean and standard deviation.)

22) _____

- A) Approximately normal, mean = 157 lb, standard deviation = 9.8 lb
- B) Normal, mean = 157 lb, standard deviation = 9.8 lb
- C) Normal, mean = 157 lb, standard deviation = 24 lb
- D) Approximately normal, mean = 157 lb, standard deviation = 4 lb

Find the requested probability.

23) The test scores of 5 students are under consideration. The following is the dotplot for the sampling distribution of the sample mean for samples of size 2.



Find the probability, expressed as a percent, that the sample mean will be equal to the population mean.

- A) 30%
- B) 5%

- C) 10%
- D) 20%

For samples of the specified size from the population described, find the mean and standard deviation of the sample mean x.

24) The mean and the standard deviation of the sampled population are, respectively, 115.3 and 36.5.

24)

A)
$$\mu_{x} = 36.5$$
; $\sigma_{x} = 4.1$

A)
$$\mu_{\overline{x}} = 36.5$$
; $\sigma_{\overline{x}} = 4.1$
C) $\mu_{\overline{x}} = 115.3$; $\sigma_{\overline{x}} = 4.1$

B)
$$\mu_{\nu} = 4.1$$
; $\sigma_{\nu} = 115.3$

B)
$$\mu_{-} = 4.1$$
; $\sigma_{-} = 115.3$
D) $\mu_{-} = 280.6$; $\sigma_{-} = 2.8$

Find the confidence interval specified.

25) A random sample of 131 full-grown lobsters had a mean weight of 15 ounces. Assume that σ = 3.4 ounces. Construct a 95% confidence interval for the population mean μ .

25) _____

A) 14.2 to 15.8 ounces

B) 14.4 to 15.6 ounces

C) 14.5 to 15.5 ounces

D) 14.3 to 15.7 ounces

Solve the problem.

26) Based on a sample of 40 randomly selected years, a 90% confidence interval for the mean annual precipitation in one city is from 42.7 inches to 45.3 inches. Find the margin of error.

26) _____

A) 2.6 inches

B) 0.34

C) 1.3 inches

D) There is not enough information to find the margin of error.

Find the confidence interval specified. Assume that the population is normally distributed.

27) A savings and loan association needs information concerning the checking account balances of its local customers. A random sample of 14 accounts was checked and yielded a mean balance of \$664.14 and a standard deviation of \$297.29. Find a 90% confidence interval for the true mean checking account balance for local customers.

27)

A) \$523.43 to \$804.85

B) \$492.52 to \$835.76

C) \$493.71 to \$834.57

D) \$455.65 to \$872.63

Find the requested value.

28) A long-distance phone company wishes to estimate the mean duration of long-distance calls originating in California. A random sample of 15 long-distance calls originating in California yields the following call durations, in minutes.

28)

29) _____

2 3 2 4 2 14 10 18 24 28

1 19 12 2 37

Use the data to obtain a point estimate of the mean call duration for all long-distance calls originating in California.

A) 12.5 minutes

B) 12.0 minutes

C) 12.3 minutes

D) 11.9 minutes

A sample mean, sample size, and population standard deviation are given. Use the one-mean z-test to perform the required hypothesis test at the given significance level. Use the critical -value approach.

29)
$$\bar{x} = 20$$
, $n = 60$, $\sigma = 1.5$, H_0 : $\mu = 22$; H_a : $\mu \neq 22$, $\alpha = 0.05$

A) z = -10.33; critical values = ± 1.645 ; reject H₀

B) z = -10.33; critical values = ± 1.645 ; do not reject H₀

C) z = -10.33; critical values = ± 1.96 ; reject H₀

D) z = -10.33; critical values = ± 1.96 ; do not reject H₀

For the	given h	vpothesis test,	explain the me	eaning of a Tv	pe I error, a	Гуре II error, с	or a correct d	ecision as specified.
	,	,,			F			

30) A manufacturer claims that the mean amount of juice in its 16 ounce bottles is 16.1 ounces. A consumer advocacy group wants to perform a hypothesis test to determine whether the mean amount is actually less than this. The hypotheses are:

$$H_0: \mu = 16.1 \text{ ounces}$$

$$H_a: \mu < 16.1$$
 ounces

where μ is the mean amount of juice in the manufacturer's 16 ounce bottles. Explain the meaning of a Type I error.

- A) A Type I error would occur if, in fact, μ < 16.1 ounces, but the results of the sampling lead to the conclusion that μ > 16.1 ounces.
- B) A Type I error would occur if, in fact, μ < 16.1 ounces, but the results of the sampling fail to lead to that conclusion.
- C) A Type I error would occur if, in fact, μ = 16.1 ounces, but the results of the sampling do not lead to rejection of that fact.
- D) A Type I error would occur if, in fact, μ = 16.1 ounces, but the results of the sampling lead to the conclusion that μ < 16.1 ounces.

Solve the problem.

- 31) A variable of two populations has a mean of 39 and a standard deviation of 11 for one of the populations and a mean of 32 and a standard deviation of 15 for the other population. For independent samples of sizes 4 and 20, respectively, find the mean of $\overline{x_1} \overline{x_2}$.
- 31)

A) 7

B) -7

C) 71

D) 8.2

Determine the null and alternative hypotheses for the proposed hypothesis test.

32) A researcher wants to perform a hypothesis test to determine whether the mean credit card debt for credit card holders aged 18–35 is greater than the mean credit card debt for credit card holders aged over 35.



- A) Let μ_1 denote the mean credit card debt for credit card holders aged 18–35 and let μ_2 denote the mean credit card debt for credit card holders over 35. The null and alternative hypotheses are H_0 : $\mu_1 = \mu_2$ and H_a : $\mu_1 < \mu_2$.
- B) Let μ_1 denote the mean credit card debt for credit card holders aged 18–35 and let μ_2 denote the mean credit card debt for credit card holders over 35. The null and alternative hypotheses are H_0 : $\mu_1 > \mu_2$ and H_a : $\mu_1 < \mu_2$.
- C) Let μ_1 denote the mean credit card debt for credit card holders aged 18–35 and let μ_2 denote the mean credit card debt for credit card holders over 35. The null and alternative hypotheses are H_0 : $\mu_1 = \mu_2$ and H_a : $\mu_1 > \mu_2$.
- D) Let $\overline{x_1}$ denote the mean credit card debt for credit card holders aged 18–35 and let $\overline{x_2}$ denote the mean credit card debt for credit card holders over 35. The null and alternative hypotheses are $H_0: \overline{x_1} = \overline{x_2}$ and $H_a: \overline{x_1} > \overline{x_2}$.

FREE RESPONSE

- 1. A fair six-sided die is rolled. The faces are numbered 1 through 6.
 - (a) List all possible outcomes of the roll.
 - (b) List the outcomes of the event

A = an even number is rolled

(c) List the outcomes of the event

B =the number rolled is at most 2

- (d) List the outcomes of (A & B), if any.
- (e) Draw a Venn diagram illustrating the relationship between A and B. Then shade the part representing (A or B).
- - (a) Compute S_{xx} , S_{xy} , S_{yy} .
 - (b) Compute the least-squares estimates b_0 and b_1 .
- 3. In one city, convicted burglars are sentenced to an average of 18.7 months in prison. A researcher wants to perform a hypothesis test to determine whether the mean sentence handed down by one particular judge for burglars differs from 18.7 months. She takes a random sample of 38 such cases from the court files of this judge and finds that $\overline{x} = 17$ months. Assume that the <u>population</u> standard deviation is 7.1 months. Test the hypothesis at the 5% significance level:
 - (a) State the null and alternative hypotheses.
 - (b) What is α ?
 - (c) Compute the value of the test statistic.
 - (d) Determine the critical value(s).
 - (e) State the conclusion of your test.
- 4. The networks for the top 20 television shows are shown in the following table.

CBS	ABC	CBS	ABC	ABC
Fox	CBS	CBS	Fox	CBS
ABC	CBS	CBS	CBS	Fox
Fox	Fox	CBS	Fox	ABC

- (a) Make a table of the frequency distribution.
- (b) Make a table of the relative-frequency distribution.
- (c) Construct a bar chart of the <u>relative</u>-frequency distribution. Remember to label the vertical axis (with numbers) and label each bar.

Formula/Table Card for Weiss's Elementary Statistics, 8/e Larry R. Griffey

0 7

Table II Areas under the standard normal curve

-			255	accord according place in	Dia C	7				
0.09	0.08	0.07	90:0	0.05	0.04	0.03	0.02	0.01	0.00	z
									0,0000	-3.9
0.000	0.000			0000	0000		0.0001	0.0001	0.0001	-3.8
0.000	0.00			0000	000		0000	0000	0000	-3.7
0000	000				0.0001	0.000	0.0001	0.0002	0.0002	-3.6
0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	-3.5
0.0002	0.000	0000	0.0003	0.000	0.0003	0 0003	0.0003	0.000	0.0003	
0.0003	0.000			0000			0000	0.000	0000	2.2
0.0005	0.0005			0 0006			2000	0000	0000	5
0.0007	0.0007		_	0.000			0000	0000	2000	7.6
0.000	0.0010			0.0011			0.0013	0.000	00013	-3.0
7100	41000			2						
0.0010	0.000			0.0010	0.0010	0.0017	0.0018	0.0018	0.0019	6.7-
2000	0.000			0.0026			0.0024	0.0023	97000	877-
0.0020	0.0027			0.0030	_	0.0032	0.0033	0.0034	0.0035	-2.7
0000	0.0007			0.0040			0.0044	0.00	0.0047	-2.6
0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0000	0.0062	-2.5
0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082	-24
0.0084	0.0087	0.0089	0.0091	0.0094	0.0096		00100	0000	0.0107	7
0.010	0.0113			0.0122	0.0125		25100	98100	0.000	2,2
0.0143	0.0146	-		0.0158	0.0162	0.0166	07100	0.0174	0.0170	-2.1
0.0183	0.0188			0.0202	0.0207	0.0212	0.0217	0.022	0.028	200
6600	0000		9							i
0.0233	0.0239		0.020	0.025	0.0262	0.0268	0.0274	0.0281	0.0287	6.7
100	0.0301	0.0307	0.0514	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359	-1.8
0.0367	0.0375	0.0384	0.0392	0.040	0.0403	0.0418	0.0427	0.0436	0.0446	-1.7
0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548	9.7-
0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668	-1.5
0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808	-14
0.0823	0.0838	0.0853	0.0869	0.0885	0000	81600	0.0034	0.0051	0.0068	~
0.0985	0.1003	0.1020	0.1038	0.1056	0 1075	0 1093	01110	200	15110	
0.1170	06110	0.1210	01230	1361.0	0.1771	0 1303	71210	0.1336	73610	: -
0.1379	0.1401	0.1423	0.1446	0.1469	0 1492	51510	01530	0.1562	0 1587	177
;								700	10/21/2	2.7
1101.0	0.1653	0.1000	C801.0	0.1711	0.1736	0.1762	0.1788	0.1814	<u>-</u>	-0.9
0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119	-0.8
0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420	-0.7
0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743	90-
0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085	50-
0.3121	3315.0	03103	0,2230	1760	23,00	2000	5			
1717.0	0.2520	2416.0	0.3220	P075.0	0.3300	0.3330	0.3372	0.5409	0.3440	+·0-
000	0.3520	0.3337	0.5594	0.3632	0.3669	0.3/0/	0.3745	0.3783	0.3821	-0.3
0.3839	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207	-0.2
0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602	-0.1

For z < -3.90, the areas are 0.0000 to four decimal places

 † For $z \ge 3.90$, the areas are 1.0000 to four decimal places.

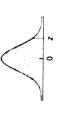
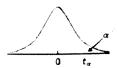


Table II (cont.) Areas under the standard normal curve

Second decimal place in z

0.00 0.01 0.02 0.03 0.04 0.5000 0.5000 0.5000 0.5120 0.5160 0.5160 0.5398 0.548 0.5478 0.5517 0.5537 0.5357 0.5398 0.5481 0.5411 0.5910 0.5341 0.5481 0.6574 0.6217 0.6253 0.6293 0.6393 0.6393 0.631 0.6554 0.6591 0.6628 0.6644 0.6700 0.6700 0.6700 0.6515 0.6592 0.6698 0.7019 0.7734 0.7734 0.7734 0.7580 0.7611 0.7522 0.7021 0.7734 0.7734 0.7734 0.7581 0.7911 0.7734 0.7747 0.7734 0.7744 0.7734 0.7744 0.7581 0.7911 0.7734 0.7848 0.8876 0.8876 0.8726 0.9476 0.9493 0.9484 0.9495 0.9499 0.9466 0.9493 0.9494 0.9494 0.9494 0.9494 0.9494				The second secon						
0.57070 0.5040 0.5080 0.5120 0.5160 0.5398 0.5338 0.5438 0.5478 0.5517 0.5557 0.5393 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6579 0.6570 0.6579 0.6570 0.6579 0.6570 0.6579 0.6570 0.6579 0.6570 0.6579 0.6570 0.6579 0.6570 0.7580 0.7581 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.8413 0.8418 0.8461 0.8485 0.8879 0.8825 0.8925 0.9930 0.9192 0.9209 0.9192 0.9209 0.9192 0.9245 0.9240 0.9242 0	0.00	0.01	0.02	0.03	0.04	0.05	90.0	0.07	0.08	0.09
0.53000 0.53040 0.53080 0.51150 0.53070 0.5309 0.5438 0.5478 0.5478 0.5478 0.5478 0.5478 0.5478 0.5478 0.6579 0.6517 0.5557 0.6539 0.6531 0.6519 0.6517 0.6525 0.6293 0.6331 0.6519 0.6517 0.6525 0.6293 0.6331 0.6519 0.6517 0.6525 0.6293 0.6331 0.6519 0.7524 0.7529 0.7529 0.7524 0.7529 0.7524 0.7529 0.75								-	-	
0.5398 0.5438 0.5478 0.5517 0.5537 0.5398 0.6438 0.6517 0.6255 0.6010 0.6534 0.6617 0.6255 0.6010 0.6534 0.6617 0.6255 0.6031 0.6538 0.6644 0.6170 0.6554 0.6629 0.6638 0.6644 0.6000 0.6915 0.7257 0.7291 0.7324 0.7357 0.7395 0.7387 0.7389 0.7381 0.7381 0.7391 0.7392 0.7382 0.7381 0.7381 0.7391 0.7393 0.7367 0.7393 0.7381 0.7391 0.7393 0.7364 0.8813 0.8813 0.8843 0.8869 0.8888 0.8907 0.8925 0.9032 0.9043 0.9043 0.9043 0.9043 0.9043 0.9043 0.9044 0.9043 0.9043 0.9043 0.9044 0.9043 0.9043 0.9043 0.9043 0.9044 0.9043 0.9041 0.9044 0.9048 0.9041 0.9044 0.9048 0.9041 0.	0.5000		0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.5793 0.5812 0.5871 0.5910 0.5948 0.6179 0.6217 0.6255 0.6629 0.6570 0.6554 0.6570 0.6554 0.6570 0.6554 0.6570 0.6554 0.6570 0.6554 0.6570 0.6581 0.6582 0.6570 0.6581 0.6582 0.6582 0.6590 0.6582 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.7324 0.8159 0.8159 0.8186 0.8212 0.8238 0.8264 0.9312 0.9322 0.9452 0.9322 0.9452 0.	0.5398		0.5478	0.5517	0.5557	0.5596	0.5636	5675	0.5714	0.5753
0.6179 0.6217 0.6253 0.6293 0.6313 0.6534 0.6519 0.6628 0.6664 0.6700 0.6915 0.6528 0.6391 0.7014 0.7324 0.8225 0.8433 0.8849 0.8849 0.8849 0.8849 0.8849 0.8849 0.8849 0.8849 0.8849 0.8849 0.8849 0.9849 0.9422 0.9423 0.9324 0.9324 0.9324 0.9324 0.9324 0.9424 0.9434 0.	0.5793		0.5871	0.5010	0.5048	0 5087		_	0.6103	0 6141
0.05179 0.05217 0.05238 0.05239 0.05331 0.05618 0.05642 0.05031 0.05628 0.05642 0.05031 0.05628 0.05642 0.05031 0.05235 0.0523 0.05235 0.07357 0.7359	02130		2000	0000	0.00	0.720	0700.0			0.0141
0.6554 0.6591 0.6628 0.6664 0.6700 0.6554 0.6591 0.6628 0.7019 0.7054 0.7358 0.7257 0.7291 0.7324 0.7358 0.7291 0.7324 0.7358 0.7291 0.7324 0.7358 0.7291 0.7358 0.7291 0.7389 0.7611 0.7452 0.7492 0.7494 0.7481 0.7481 0.7492 0.7492 0.8159 0.825 0.9192 0.9032 0.9049 0.9052 0.9	0.0179		0.0233	0.0293	0.0331	0.0.508	0.0400	_	0.6480	0.6517
0.6915 0.6950 0.6985 0.7019 0.7054 0.7257 0.7291 0.7324 0.7354 0.7357 0.7389 0.7280 0.7011 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.7042 0.8159 0.8166 0.8212 0.8238 0.8264 0.8843 0.8864 0.8843 0.8864 0.8848 0.8907 0.8925 0.9032 0.9032 0.9042 0.	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.7257 0.7291 0.7324 0.7357 0.7389 0.7580 0.7580 0.7611 0.7642 0.7642 0.7643 0.7044 0.7389 0.7064 0.7881 0.7011 0.7394 0.7955 0.7881 0.7910 0.7399 0.7967 0.7995 0.8186 0.8212 0.8238 0.8264 0.8212 0.8238 0.8264 0.8212 0.8238 0.8207 0.8202 0.9192 0.9192 0.9022 0.9022 0.9032 0.	0.6915	_	0.6985	0.7019	0.7054	0 7088	0.7133	0.7157	0.7100	0.7774
0.7580 0.7511 0.7524 0.7523 0.7503 0.7580 0.7581 0.7580 0.7511 0.7580 0.7581 0.8841 0.8848 0.8872 0.8872 0.8843 0.8848 0.8872 0.8872 0.9872 0.9032 0.9049 0.9050 0.9032 0.9049 0.9050 0.9032 0.9045 0.9051 0.9052 0.	17757		7334	0.7357	0 7290	0.747.0	0.7464			0.75.5
0.77881 0.77942 0.77942 0.77794 0.77784 0.77784 0.77784 0.77784 0.77784 0.77784 0.77784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7784 0.7886 0.8876 0.8876 0.8876 0.8876 0.8876 0.8872 0.9093 0.9192 0.9070 0.9272 0.9732 0.9342 0.9354 0.9352 0.9452 0.9452 0.9452 0.9453 0.9452 0.9452 0.9453 0.9454 0.9484 0.9484 0.9484 0.9484 0.9494 0.9484 0.9494 0.9494 0.9494 0.9494 0.9494 0.9494 0.9494 0.9494 0.9498 0.9998 0.9991 0.9941 0.9942 0.9938 0.9914 0.9941 0.994	0.3500		0.17647	0.7577	0.7303	274770	0.7454		_	0.7349
0.7881 0.7910 0.7939 0.7967 0.7995 0.8159 0.8186 0.8212 0.8238 0.8264 0.8413 0.8438 0.8461 0.8485 0.8288 0.8264 0.8443 0.8443 0.8463 0.8443 0.8463 0.8486 0.8798 0.8729 0.8849 0.8869 0.8889 0.9922 0.9032 0.9049 0.9922 0.9222 0.9235 0.9251 0.9452 0.9452 0.9452 0.9454 0.9444 0.9484 0.9495 0.9452 0.9454 0.9444 0.9444 0.9464 0.9641 0.9649 0.9656 0.9644 0.9495 0.9452 0.9452 0.9452 0.9452 0.9454 0.9494 0.9495 0.9921 0.9864 0.9495 0.9921 0.9864 0.9495 0.9861 0.9864 0.9871 0.9874 0.9881 0.9864 0.9991 0.9904 0.9991 0.9904 0.9991 0.9904 0.9991 0.9904 0.9991 0.9904 0.9991 0.9904 0.9991 0.9904 0.9991 0.9904 0.9991 0.9904 0.9991 0.	0.7380		0.7042	0.7673	5.7.5 2.7.5	0.7734	2.7		0.7823	0.7852
0.8159 0.8186 0.8212 0.8238 0.8264 0.8413 0.8443 0.8461 0.8485 0.8508 0.88443 0.8846 0.8729 0.8849 0.8865 0.8849 0.8879 0.8239 0.9849 0.8865 0.8888 0.8971 0.8925 0.9032 0.9049 0.9032 0.9049 0.9049 0.9042 0.9032 0.9192 0.9232 0.9452 0.9452 0.9444 0.9484 0.9482 0.9452 0.9452 0.9444 0.9484 0.9482 0.9541 0.9541 0.9444 0.9484 0.9452 0.9541 0.9671 0.9719 0.9726 0.9671 0.9719 0.9726 0.9893 0.9981 0.9982 0.9991 0	0.7881		0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.8413 0.8438 0.8461 0.8485 0.8508 0.8643 0.8645 0.8866 0.8708 0.8729 0.8849 0.8865 0.8708 0.8729 0.8849 0.8869 0.8888 0.8907 0.8925 0.9032 0.9032 0.9042 0.9042 0.9042 0.9042 0.9042 0.9042 0.9042 0.9452 0.9453 0.9354 0.9352 0.9452 0.9453 0.9454 0.9484 0.9484 0.9484 0.9495 0.9541 0.9649 0.9656 0.9649 0.9656 0.9649 0.9651 0.9718 0.9718 0.9718 0.9726 0.9726 0.9732 0.9719 0.9726 0.9720 0.9931 0.9941 0.	0.8159		0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
0.8849 0.8869 0.8888 0.8907 0.8929 0.8949 0.8849 0.8869 0.8888 0.8907 0.8929 0.8849 0.8869 0.9888 0.8907 0.9029 0.9032 0.	0.0413	0.0430	0.0461	20100	9039	0.0531	7200		0	
0.8643 0.8665 0.8708 0.8729 0.8843 0.8972 0.8925 0.9032 0.9049 0.8868 0.8907 0.9025 0.9032 0.9032 0.9049 0.9068 0.9022 0.9039 0.9192 0.9232 0.9245 0.9357 0.9372 0.9452 0.9452 0.9452 0.9454 0.9454 0.9454 0.9452 0.9452 0.9454 0.9454 0.9454 0.9454 0.9454 0.9452 0.9454 0.	0.0413		0.040	0.0400	0.000	0.8331	0.8554		0.8599	0.8621
0.8849 0.8889 0.8807 0.8925 0.9032 0.9032 0.9042 0.9062 0.9072 0.9032 0.9043 0.917 0.9222 0.9236 0.9231 0.9332 0.9345 0.9345 0.9342 0.9342 0.9342 0.9452 0.9452 0.9453 0.9453 0.9453 0.9453 0.9453 0.9454 0.9484 0.9484 0.9491 0.9641 0.9649 0.9656 0.9656 0.9664 0.9671 0.9713 0.9719 0.9726 0.9932 0.9932 0.9931 0.9981 0.9981 0.9981 0.9981 0.9941 0.9	0.8643	_	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
0.9032 0.9049 0.9066 0.9082 0.9099 0.9192 0.9332 0.9345 0.9357 0.9370 0.9382 0.9354 0.	0.8849	_	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
0.9192 0.9207 0.9222 0.9236 0.9317 0.9332 0.9345 0.9357 0.9370 0.9382 0.9452 0.9453 0.9474 0.9484 0.9495 0.9452 0.9454 0.9444 0.9495 0.9545 0.9546 0.9554 0.9554 0.9564 0.9573 0.9581 0.9641 0.9641 0.9649 0.9566 0.9646 0.9713 0.9713 0.9712 0.9712 0.9712 0.9718 0.9712 0.9912 0.9991 0.	0.9032		0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
0.9332 0.9345 0.9357 0.9370 0.9382 0.9452 0.9463 0.9474 0.9484 0.9495 0.9542 0.9544 0.9495 0.9544 0.9495 0.9541 0.9549 0.9546 0.9573 0.9511 0.9541 0.9549 0.9556 0.9564 0.9571 0.9513 0.9713 0.9712 0.9718 0.9718 0.9718 0.9718 0.9718 0.9718 0.9718 0.9718 0.9718 0.9718 0.9718 0.9719 0.9719 0.9719 0.9719 0.9719 0.9710 0.9719 0.9710 0.9711 0.9719 0.9710 0.9711 0.9719 0.9711 0.	0.9192		0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
0.9452 0.9463 0.9474 0.9484 0.9495 0.9554 0.9554 0.9564 0.9573 0.9582 0.9591 0.9541 0.9484 0.9495 0.9541 0.9549 0.9556 0.9573 0.9573 0.9573 0.9738 0.9732 0.9738 0.9732 0.9738 0.9732 0.9738 0.9732 0.9738 0.9732 0.9738 0.9814 0.9824 0.9838 0.9941 0.9841 0.9941 0.	0.9332	0.9345	0.9357	0.9370	0.9382	0 9394	0 9406	81760	0.0470	0.0441
0.9554 0.9564 0.9573 0.9582 0.9591 0.9641 0.9649 0.9656 0.9656 0.9664 0.9671 0.9713 0.9712 0.9726 0.9726 0.9732 0.9738 0.9712 0.9726 0.9833 0.9788 0.9738 0.9812 0.9821 0.9864 0.9864 0.9871 0.9814 0.9814 0.9814 0.9914 0.9918 0.9918 0.9918 0.9918 0.9918 0.9920 0.9922 0.9925 0.9925 0.9928 0.9918 0.9938 0.9941 0.9941 0.9941 0.9941 0.9941 0.9941 0.9941 0.9941 0.9941 0.9941 0.9941 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9981 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999	0.9452		0.0474	0.0484	0.0405	90800	0.0516	90506	0.0636	0.0646
0.9541 0.9574 0.9573 0.9564 0.9573 0.9541 0.9571 0.9572 0.9572 0.9573 0.9574 0.9573 0.9573 0.9573 0.9573 0.9573 0.9573 0.9573 0.9772 0.9772 0.9726 0.9732 0.9732 0.9732 0.9732 0.9732 0.9732 0.9732 0.9732 0.9732 0.9732 0.9831 0.9842 0.9864 0.9864 0.9864 0.9864 0.9864 0.9953 0.9952 0.9952 0.9953 0.9955 0.9956 0.9956 0.9956 0.9965 0.9966 0.9966 0.9966 0.9967 0.9968 0.9997 0.9999	0.0554		0.0672	0.000	0.000	00200	0.000	0.752.0	0.9333	0.9343
0.9713 0.9718 0.9726 0.9732 0.9738 0.9731 0.9713 0.9718 0.9778 0.9778 0.9732 0.	1000	10000	0.000	2006.0	16060	66660	0.9008	0.9016	C79670	0.9633
0.9713 0.9719 0.9726 0.9732 0.9738 0.9772 0.9778 0.9783 0.9782 0.9782 0.9782 0.9782 0.9782 0.9783 0.9782 0.9873 0.9873 0.9873 0.9874 0.9834 0.9884 0.9884 0.9884 0.9814 0.9916 0.9918 0.9920 0.9922 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9926 0.9938 0.9941 0.9941 0.9941 0.9941 0.9987 0.9988 0.9994 0.9994 0.9994 0.9994 0.9994 0.9994 0.9994 0.9994 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9999	T	0.9049	0.9630	2.50 400 400 400	708.5	20/8	0.9686	2,963	0.5695	0.9706
0.9772 0.9778 0.9783 0.9788 0.9793 0.9821 0.9821 0.9826 0.9830 0.9831 0.9871 0.9872 0.9893 0.9893 0.9864 0.9888 0.9901 0.9904 0.9918 0.9918 0.9918 0.9918 0.9918 0.9918 0.9922 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9927 0.9931 0.	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
0.9821 0.9826 0.9830 0.9834 0.9838 0.9864 0.9864 0.9868 0.9971 0.9875 0.9893 0.9866 0.9888 0.9901 0.9904 0.9938 0.9918 0.9902 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9925 0.9982 0.9981 0.9981 0.9982 0.9982 0.9982 0.9982 0.9982 0.9982 0.9982 0.9983 0.9999 0.9999	0.9772		0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
0.9861 0.9864 0.9868 0.9871 0.9875 0.9893 0.9904 0.9918 0.9920 0.9925 0.9927 0.9927 0.9928 0.9910 0.9944 0.9938 0.9910 0.9945 0.9933 0.9953 0.9955 0.9956 0.9956 0.9957 0.9956 0.9957 0.9987 0.9987 0.9987 0.9987 0.9987 0.9987 0.9987 0.9987 0.9988 0.9998 0.9999 0.9999 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9999	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
0.9993 0.9896 0.9901 0.9904 0.9918 0.9920 0.9922 0.9925 0.9927 0.9938 0.9940 0.9941 0.9943 0.9945 0.9953 0.9956 0.9956 0.9959 0.9974 0.9975 0.9968 0.9968 0.9974 0.9975 0.9976 0.9977 0.9981 0.9987 0.9987 0.9988 0.9988 0.9990 0.9991 0.9991 0.9991 0.9992 0.9993 0.9993 0.9994 0.9994 0.9994 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0 9887	0.0800
0.9918 0.9920 0.9922 0.9925 0.9927 0.9938 0.9948 0.9940 0.9941 0.9941 0.9943 0.9945 0.9956 0.9956 0.9956 0.9956 0.9956 0.9956 0.9956 0.9956 0.9956 0.9956 0.9957 0.9957 0.9977 0.9977 0.9987 0.9987 0.9987 0.9987 0.9988 0.9988 0.9988 0.9998 0.9999 0.9999 0.9999 0.9999 0.9999 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9999	0.9893	0.9896	0 9898	10000	0 0004	90000	0.0000	0.001	0.0012	0.000
0.9938 0.9940 0.9941 0.9943 0.9945 0.9953 0.9955 0.9956 0.9957 0.9958 0.9966 0.9977 0.9958 0.9978 0.9982 0.9982 0.9982 0.9982 0.9982 0.9982 0.9983 0.9984 0.9991 0.9999 0.9998 0.9998 0.9998 0.9998 0.9998 0.9999	0 0018	0.000	0.000	0 9025	0.007	0.000	1000	0.0033	0.000	0.000
0.9938 0.9940 0.9941 0.9943 0.9945 0.9958 0.9958 0.9956 0.9957 0.9958 0.9966 0.9977 0.9968 0.9976 0.9978 0.9978 0.9978 0.9978 0.9978 0.9982 0.9982 0.9982 0.9982 0.9983 0.9994 0.9993 0.9994 0.9994 0.9995 0.9995 0.9995 0.9995 0.9995 0.9996 0.9998 0.9998 0.9998 0.9998 0.9999			+		0.77	0.772	0.3331	0.3332	0.3754	0.99.50
0.9953 0.9956 0.9956 0.9959 0.9959 0.9965 0.9965 0.9968 0.9968 0.9968 0.9967 0.9977 0.9977 0.9977 0.9977 0.9978 0.9988 0.9998 0.9999	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
0.9965 0.9966 0.9967 0.9968 0.9969 0.9974 0.9974 0.9975 0.9976 0.9977 0.9977 0.9981 0.9981 0.9982 0.9983 0.9984 0.9982 0.9983 0.9984 0.9984 0.9993 0.9993 0.9993 0.9995 0.9995 0.9995 0.9995 0.9996 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9998 0.9999	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	1966.0	0.9962	0.9963	0.9964
0.9974 0.9975 0.9976 0.9977 0.9977 0.9977 0.9981 0.9981 0.9982 0.9983 0.9984 0.9988 0.9988 0.9988 0.9989 0.9999	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
0.9981 0.9982 0.9983 0.9984 0.9987 0.9987 0.9987 0.9987 0.9987 0.9988 0.9988 0.9998 0.9993 0.9994 0.9995 0.9995 0.9995 0.9995 0.9995 0.9995 0.9995 0.9995 0.9998 0.9998 0.9998 0.9998 0.9998 0.9999	0.9974	0.9975	9266.0	126.0	1266.0	0.9978	0.9979	0.9979	0.9980	0.9981
0.9987 0.9987 0.9988 0.9988 0.9988 0.9990 0.9991 0.9991 0.9991 0.9992 0.9993 0.9994 0.9994 0.9994 0.9995 0.9995 0.9995 0.9995 0.9995 0.9995 0.9998 0.9998 0.9998 0.9998 0.9999	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
0.9990 0.9991 0.9991 0.9991 0.9992 0.9993 0.9993 0.9994 0.9994 0.9994 0.9994 0.9994 0.9994 0.9994 0.9998 0.9998 0.9998 0.9998 0.9998 0.9999	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0 9989	0 0000	0 0000
0.9993 0.9994 0.9994 0.9994 0.9994 0.9994 0.9995 0.9995 0.9995 0.9995 0.9996 0.9996 0.9996 0.9998 0.9998 0.9998 0.9998 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999	0.6660	0.9991	1666 0	16660	0.9992	0 9992	0 9992	0 0000	0 0003	0 0003
0.9993 0.9993 0.9993 0.9994 0.9994 0.9994 0.9994 0.9994 0.9998 0.9998 0.9998 0.9998 0.9999	0.9993	0.9993	0.9994	0 9994	0 0004	0 0004	0 0004	0 0005	0 0005	0.0005
0.9990 0.	0.0005	0 0005	0 0005	90000	0 0006	0.0006	00000	0.000	0.000	CKKK'D
66660 66660 66660 66660 66660 66660 86600 86660 86600 86600 86600 86600 86600 86600 86600 86600 86600 86600 86600 86600 86600 86600 866000	0 9997	0 0007	0.0007	0.0000	0.0000	0.0000	0.000.0	0.0000	0.000.0	0.9997
8666.0 86660.0 86660.0 86660.0 86660.0 86660.0 86660.0 86660.0 86660.0 8						0.2223	0.7777	0.3331	0.3331	0.3330
99999 0,99998 0,99999 0,9999 0,999 0,9999 0,9999 0,9999 0,9999 0,9999 0,999 0,999 0,9999 0,9999 0,9999 0,999 0,999 0,9	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
6666'0 6660'0 6666'0 6660'0 66	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	6666.0	0.9999	0.9999
0.9999 0.9999 0.9999 0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
_	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	6666.0	0.9999	0.9999	0.9999
3.9 1.0000°	1.0000									

TABLE IV



NOTE: See the version of Table IV in Appendix A for additional values of t_{α} .

df	<i>t</i> _{0.1} €	t 9.05	t 0.025	t 0.91	t 0.005	df
" 1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.9 65	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.36 5	4.032	5
6	1.440	1.943	2.447	3.143	3.70 7	6
7	1.415	1.895	2.365	2.998	3.49 9	7
8	1.397	1.860	2.306	2.896	3.35 5	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
ΙÍ	1.363	1.796	2.201	2.718	3.10 6	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.131	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
3 0	1.310	1.697	2.042	2.457	2.750	30
3 5	1.306	1.690	2.030	2.438	2.724	35
40	1.303	1.684	2.021	2.423	2.704	40
50	1.299	1.676	2.009	2.403	2.678	50
60	1.296	1.671	2.000	2.390	2.660	60
70	1.294	1.667	1.994	2.381	2.648	70
8 0	1.292	1.664	1.990	2.374	2.639	80
90	1.291	1.662	1.987	2.369	2.632	90
10 0	1.290	1.660	1.984	2.364	2.626	100
10 00	1.282	1.646	1.962	2.330	2.581	1000
2000	1.282	1.646	1.961	2.328	2.578	2000

1.282	1.645	1.960	2.326	2.576
Z 0.10	Z 0.05	Z 0.025	Z 0.01	Z 0.005

Notation

n = sample size

 $\bar{x} = \text{sample mean}$

s = sample stdev

 $Q_i = j$ th quartile

N = population size

 $\mu = population mean$

 σ = population stdev

d = paired difference

 $\hat{p} = \text{sample proportion}$

p = population proportion

O =observed frequency

E = expected frequency

Chapter 3 Descriptive Measures

• Sample mean:
$$\bar{x} = \frac{\sum x_i}{n}$$

• Range: Range = Max - Min

• Sample standard deviation:

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$
 or $s = \sqrt{\frac{\sum x_i^2 - (\sum x_i)^2/n}{n - 1}}$

• Interquartile range: $IQR = Q_3 - Q_1$

- Lower limit = $Q_1 1.5 \cdot IQR$, Upper limit = $Q_3 + 1.5 \cdot IQR$
- Population mean (mean of a variable): $\mu = \frac{\sum x_i}{N}$
- Population standard deviation (standard deviation of a variable):

$$\sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{N}}$$
 or $\sigma = \sqrt{\frac{\sum x_i^2}{N} - \mu^2}$

• Standardized variable: $z = \frac{x - \mu}{\sigma}$

Chapter 4 Descriptive Methods in Regression and Correlation

• S_{vv} , S_{vv} , and S_{vv} :

 $S_{xx} = \sum (x_i - \bar{x})^2 = \sum x_i^2 - (\sum x_i)^2 / n$

 $S_{xy} = \sum (x_i - \bar{x})(y_i - \bar{y}) = \sum x_i y_i - (\sum x_i)(\sum y_i)/n$

 $S_{yy} = \sum (y_i - \bar{y})^2 = \sum v_i^2 - (\sum y_i)^2 / n$

• Regression equation: $\hat{y} = b_0 + b_1 x$, where

 $b_1 = \frac{S_{xy}}{S_{xx}}$ and $b_0 = \frac{1}{n} (\Sigma y_i - b_1 \Sigma x_i) = \bar{y} - b_1 \bar{x}$

• Total sum of squares: $SST = \sum (y_i - \bar{y})^2 = S_{yy}$

- Regression sum of squares: $SSR = \sum (\hat{y}_i \bar{y})^2 = S_{xy}^2 / S_{xx}$
- Error sum of squares: $SSE = \sum (y_i \hat{y}_i)^2 = S_{vv} S_{vv}^2 / S_{vr}$
- Regression identity: SST = SSR + SSE
- Coefficient of determination: $r^2 = \frac{SSR}{SST}$
- Linear correlation coefficient:

$$r = \frac{\frac{1}{n-1} \sum (x_i - \bar{x})(y_i - \bar{y})}{s_x s_y} \quad \text{or} \quad r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}}$$

Chapter 5 Probability and Random Variables

• Probability for equally likely outcomes:

 $P(E) = \frac{f}{N}$

where f denotes the number of ways event E can occur and N denotes the total number of outcomes possible.

· Special addition rule:

 $P(A \text{ or } B \text{ or } C \text{ or } \cdots) = P(A) + P(B) + P(C) + \cdots$

(A, B, C, ... mutually exclusive)

- Complementation rule: P(E) = 1 P(not E)
- General addition rule: P(A or B) = P(A) + P(B) P(A & B)
- Mean of a discrete random variable X: $\mu = \sum x P(X = x)$
- Standard deviation of a discrete random variable X:

 $\sigma = \sqrt{\sum (x - \mu)^2 P(X = x)}$ or $\sigma = \sqrt{\sum x^2 P(X = x) - \mu^2}$

- Factorial: $k! = k(k-1) \cdots 2 \cdot 1$
- Binomial coefficient: $\binom{n}{x} = \frac{n!}{x!(n-x)!}$
- Binomial probability formula:

$$P(X = x) = \binom{n}{x} p^{x} (1 - p)^{n-x}$$

where n denotes the number of trials and p denotes the success probability.

- Mean of a binomial random variable: $\mu = np$
- Standard deviation of a binomial random variable:

$$\sigma = \sqrt{np(1-p)}$$

Chapter 6 The Normal Distribution

• z-score for an x-value: $z = \frac{x - \mu}{\sigma}$

• x-value for a z-score: $x = \mu + z \cdot \sigma$

Chapter 7 The Sampling Distribution of the Sample Mean

• Mean of the variable \bar{x} : $\mu_{\bar{x}} = \mu$

• Standard deviation of the variable \bar{x} : $\sigma_{\bar{x}} = \sigma/\sqrt{n}$

Formula/Table Card for Weiss's Elementary Statistics, 8/e

Larry R. Griffey

Chapter 8 Confidence Intervals for One Population Mean

• Standardized version of the variable \bar{x} :

$$z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

• z-interval for μ (σ known, normal population or large sample):

$$\bar{x} \pm z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$$

• Margin of error for the estimate of μ : $E = z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$

Sample size for estimating μ:

$$n = \left(\frac{z_{\alpha/2} \cdot \sigma}{E}\right)^2$$

rounded up to the nearest whole number.

• Studentized version of the variable \bar{x} :

$$t = \frac{\bar{x} - \mu}{s / \sqrt{n}}$$

• t-interval for μ (σ unknown, normal population or large sample):

$$\bar{x} \pm t_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$$

with df = n - 1.

Chapter 9 Hypothesis Tests for One Population Mean

• z-test statistic for H_0 : $\mu = \mu_0$ (σ known, normal population or large sample):

$$z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

• *t*-test statistic for H_0 : $\mu = \mu_0$ (σ unknown, normal population or large sample):

$$t = \frac{\bar{x} - \mu_0}{s / \sqrt{n}}$$

with df = n - 1.

Chapter 10 Inferences for Two Population Means

· Pooled sample standard deviation:

$$s_{p} = \sqrt{\frac{(n_{1} - 1)s_{1}^{2} + (n_{2} - 1)s_{2}^{2}}{n_{1} + n_{2} - 2}}$$

• Pooled *t*-test statistic for H_0 : $\mu_1 = \mu_2$ (independent samples, normal populations or large samples, and equal population standard deviations):

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{(1/n_1) + (1/n_2)}}$$

with df = $n_1 + n_2 - 2$.

• Pooled *t*-interval for $\mu_1 - \mu_2$ (independent samples, normal populations or large samples, and equal population standard deviations):

$$(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2} \cdot s_p \sqrt{(1/n_1) + (1/n_2)}$$

with df = $n_1 + n_2 - 2$.

• Degrees of freedom for nonpooled t-procedures:

$$\Delta = \frac{\left[(s_1^2/n_1) + (s_2^2/n_2) \right]^2}{\frac{(s_1^2/n_1)^2}{n_1 - 1} + \frac{(s_2^2/n_2)^2}{n_2 - 1}}$$

rounded down to the nearest integer.

• Nonpooled *t*-test statistic for H_0 : $\mu_1 = \mu_2$ (independent samples, and normal populations or large samples):

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{(s_1^2/n_1) + (s_2^2/n_2)}}$$

with $df = \Delta$.

 Nonpooled t-interval for μ₁ - μ₂ (independent samples, and normal populations or large samples):

$$(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2} \cdot \sqrt{(s_1^2/n_1) + (s_2^2/n_2)}$$

with $df = \Delta$.

• Paired *t*-test statistic for H_0 : $\mu_1 = \mu_2$ (paired sample, and normal differences or large sample):

$$t = \frac{\bar{d}}{s_d / \sqrt{n}}$$

with df = n - 1.

• Paired *t*-interval for $\mu_1 - \mu_2$ (paired sample, and normal differences or large sample):

$$\bar{d} \pm t_{\alpha/2} \cdot \frac{s_d}{\sqrt{n}}$$

with df = n - 1.