MAT1272 Statistics Formula Sheet

Weighted Mean $= \dfrac{\sum xw}{\sum w}$

Median = Value of the middle term in a ranked data set

Width of a class = Lower limit of the next class – Lower limit of the current class

Class midpoint $= \dfrac{\text{Lower limit} + \text{Upper limit}}{2}$

Range = Largest value – Smallest value

The Kth percentile: P_k = Value of the $\left(\dfrac{kn}{100}\right)$th term in a ranked data set

Percentile rank of $x_i = \dfrac{\text{Number of values less than } x_i}{\text{Total number of values in the data set}} \times 100\%$

K% Trimmed Mean = Mean of the values after dropping K% of the values from each end of the ranked data

Mean: $\mu = \dfrac{\sum x}{N}$ (population),

Variance and standard deviation: $\sigma = \sqrt{\dfrac{\sum x^2 - \dfrac{\left(\sum x\right)^2}{N}}{N}}$ (population standard deviation),

population variance = σ^2

Mean: $\bar{x} = \dfrac{\sum x}{n}$ (sample),

Variance and standard deviation: $s = \sqrt{\dfrac{\sum x^2 - \dfrac{\left(\sum x\right)^2}{n}}{n-1}}$ (sample standard deviation),

sample variance = s^2

Interquartile range: $\text{IQR} = Q_3 - Q_1$

Lower inner fence $= Q_1 - 1.5 \times \text{IQR}$ **Upper inner fence** $= Q_3 + 1.5 \times \text{IQR}$

Discrete probability distributions: mean $\mu = \sum xP(x)$ (discrete random variable)

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

Binomial distribution: mean $\mu = np$, standard deviation: $\sigma = \sqrt{npq}$,

binomial formula $P(x) = {}_nC_x p^x q^{n-x}$

Hypergeometric probability formula: $P(x) = \dfrac{{}_rC_x \cdot {}_{N-r}C_{n-x}}{{}_NC_n}$

Counting: factorial: $x!$, permutations ${}_nP_x = \dfrac{n!}{(n-x)!}$, combinations ${}_nC_x = \dfrac{n!}{x!(n-x)!}$,

Probability: conditional probability: $P(B \mid A) = \dfrac{P(A \text{ and } B)}{\text{P(A)}}$

multiplication rule: $P(A \text{ and } B) = P(A) \cdot P(B \mid A)$ or $P(A \text{ and } B) = P(B) \cdot P(A \mid B)$

multiplication rule for independent events: $P(A \text{ and } B) = P(A) \cdot P(B)$

events A and B are independent if: $P(A) = P(A \mid B)$ or $P(B) = P(B \mid A)$

addition rule: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

addition rule for mutually exclusive events: $P(A \text{ or } B) = P(A) + P(B)$

events A and B are mutually exclusive if: $P(A \text{ and } B) = 0$

Correlation coefficient: $r = \dfrac{SS_{xy}}{\sqrt{SS_{xx} SS_{yy}}}$,

where $SS_{xx} = \sum x^2 - \dfrac{\left(\sum x\right)^2}{N}$, $SS_{yy} = \sum y^2 - \dfrac{\left(\sum y\right)^2}{N}$, $SS_{xy} = \sum xy - \dfrac{\left(\sum x\right)\left(\sum y\right)}{N}$

Linear Regression: $y = a + bx$, where $b = \dfrac{SS_{xy}}{SS_{xx}}$ and $a = \bar{y} - b\bar{x}$ and $\bar{y} = \dfrac{\sum y}{n}$

Normal Distributions: convert x to z: $z = \dfrac{x - \mu}{\sigma}$ convert z to x: $x = \mu + z\sigma$

Sampling distribution of $\bar{x}$: mean $\mu_{\bar{x}} = \mu$, standard deviation: $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$

Sampling Distribution of $\bar{x}$: convert $\bar{x}$ to z: $z = \dfrac{\bar{x} - \mu}{\sigma_{\bar{x}}}$

Hypothesis testing, σ known: $z = \dfrac{\bar{x} - \mu}{\sigma_{\bar{x}}}, \quad \sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}},$

Hypothesis testing, σ unknown: $t = \dfrac{\bar{x} - \mu}{s_{\bar{x}}}, \quad s_{\bar{x}} = \dfrac{s}{\sqrt{n}}, \; df = n - 1$

Goodness-of-fit test: $E = np, \; df = k - 1, \; \chi^2 = \sum \dfrac{(O - E)^2}{E}$

Test for independence: $E = \dfrac{(row\ total)(column\ total)}{sample\ size}, \; df = (C - 1)(R - 1), \; \chi^2 = \sum \dfrac{(O - E)^2}{E}$

Chapter 1 – Entering and Editing Data

Skip the section about Creating a Named List; we will use only the default lists (variables) named L1, L2, L3, L4, L5, L6.

First, some general hints:

Note that the TI-84 has a blue button labelled 2^{ND}, and a green button labelled ALPHA. Also, other buttons have a label on them, and most also have labels in blue and green above them. This means that most buttons are actually used for three different meanings!

In the steps below, MATH does not mean the calculator button labelled MATH; rather, it means a choice on the display screen that should be toggled over to.

After STAT is pressed, the screen shows EDIT CALC TESTS in the top line. EDIT is already shown highlighted, as well as 1:

To view lists in the editor, the steps to use are STAT>EDIT>1:Edit. Since 1: is already highlighted, press 1 or just press ENTER and you'll see columns labelled L1, L2 L3 . . . at top of screen.

To enter data in a list, type each data value and press ENTER after each, to automatically move to the next row down in that list. To type data into another list, use > or < toggles to move to desired place on screen, where that list is located. To edit values in a list, use toggle keys to get to desired location, reinput that data item completely, then press ENTER (which moves to next row down in that list).

To clear all data in a list, the steps to use are STAT>EDIT and use down arrow button to toggle down to choice 4: ClrList Press ENTER, then 2^{ND} and then 1 to indicate list 1, 2 to indicate list 2, and so on, then press ENTER. The calculator screen displays Done.

Chapter 3 – Creating Summary Statistics

This is useful to calculate the mean, the sum of the data values ($\sum x$), the sum of the squares of the data values ($\sum x^2$), the sample standard deviation (s^2), the population standard deviation (σ^2), number of data values in a sample (n), minimum data value, first quartile Q_1, median (second quartile), third quartile Q_3, and maximum data value.

To see a screen that displays all these answers, the steps to use are STAT>CALC>1: 1-Var Stats just press 1 and screen will show 1-Var Stats. Next press 2ND and then 1 for list 1, 2 for list 2, and so on, and then press ENTER. Immediately on the screen you'll see all the items listed in the paragraph above. Use the down arrow button to see the last 5 statistical items.

Chapter 13 – Finding the Regression Equation, r^2 and r

To calculate the a and b values of the regression line y = a + bx, as well as r squared and r, the steps are 2ND>Catalog (use the 0 button at the bottom of the TI-84) and press the letter D and toggle down through the alphabetical list of D items to Diagnostic On press ENTER and press ENTER again. You'll see Done on right hand side of the next line. The next steps are STAT>CALC> toggle down to 8: (this choice is LinReg (a+bx) ENTER press 2^{ND} and list number to use for the x (independent variable), press 2^{ND} and list number to use for the y (dependent variable) press ENTER. The display will show answers for a, b, r^2 and r.

Chapter 4 – Calculating Combinations and Permutations

For these calculations, MATH means the calculator button labelled MATH; it does not mean to toggle over to on the display screen, as was done for instructions for previous Chapters.

The symbol n! (read as n factorial) represents the product of all integers from n down to 1.

n! = n(n-1) (n-2) (n-3) . . . (3) (2) (1)

The steps to calculate n! are to press the numbers on the calculator associated with n, then MATH>PRB>! And then press ENTER. The result of the calculation appears on the right side of the display.

The number of combinations for selecting x from n distinct items is given by the formula

$${}_nC_x = \frac{n!}{x!(n-x)!}$$ For combinations, the order of selections is not important.

The steps to calculate ${}_nC_x$ are to press the numbers on the calculator associated with n, then MATH>PRB> nCr and then press the numbers on the calculator associated with x, and then press ENTER. The result of the calculation appears on the right side of the display.

The number of permutations for selecting the number of permutations (arrangements) of selecting x items from n distinct items, is given by the formula

$${}_nP_x = \frac{n!}{(n-x)!}$$ For permutations, the order of selections is important.

The steps to calculate ${}_nP_x$ are to press the numbers on the calculator associated with n, then MATH>PRB>nPr and then press the numbers on the calculator associated with x, and then press ENTER. The result of the calculation appears on the right side of the display.

Chapter 5 – Calculating Binomial Probabilities and Cumulative Binomial Probabilities and Binomial Probability Distribution

The binomial probability P(x) is given by the formula

$P(x) = {}_nC_x\, p^x\, q^{n-x}$, where

n = number of independent trials

p = probability of success on a trial

q = 1 – p = probability of failure on a trial

x = number of successes in n trials

n – x = number of failures in n trials

The steps to calculate P(x), which is the probability of exactly x successes, are 2nd>VARS and then toggle down to choice A: binompdf(and press ENTER. Key in n then comma then probability of success then comma and then x and then) and press ENTER. For example, 2nd>VARS binompdf (n, p, x) . This is binomial probability.

The steps to calculate P(X≤x), which is probability of less than or equal to x successes, is 2nd>VARS and then toggle down to B: binomcdf(and press ENTER. Key in n then comma then probability of success then comma and then x and then) and press ENTER. For example, 2nd>VARS binomcdf (n, p, x) . This is cumulative binomial probability.

Chapter 6 – Calculating a Left-Tail Probability, Calculating a Probability Between Two Values, Calculating a Right-Tail Probability and Determining z When a Probability is Known

Use this information in what follows. To key in -1E99, use (-) key to denote negative number, then 1, then 2nd then comma then 99. To key in 1E99, use 1, then 2nd then comma then 99. 1E99 means no upper limit, and -1E99 means no lower limit on the TI – 84 Calculator.

The steps to calculate a left-tail probability are 2nd>VARS>normalcdf(. Key in -1E99 then comma then reference number (this is the upper limit of the left tail) then comma then mean then comma then standard deviation and then) and press ENTER. The result of the calculation appears on the right side of the display.

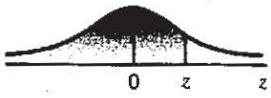
The steps to calculate a probability between two values is 2nd>VARS>normalcdf(. Key in the lower reference number (this is the lower number of the range) then comma then upper reference number (this is the upper limit of the range) then comma then mean then comma then standard deviation and then) and press ENTER. The result of the calculation appears on the right side of the display.

The steps to calculate a right-tail probability are 2nd>VARS>normalcdf(. Key in the reference number (this is the lower limit of the right tail) then comma then 1E99 then comma then mean then comma then standard deviation and then) and press ENTER. The result of the calculation appears on the right side of the display.

The steps to determine z when a probability is known are 2nd>VARS>invnormal(. Key in the reference probability then comma then mean then comma then standard deviation and then) and press ENTER. The result of the calculation appears on the right side of the display.

Table IV Standard Normal Distribution Table (continued)

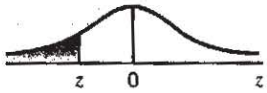
The entries in the table on this page give the cumulative area under the standard normal curve to the left of z with the values of z equal to 0 or positive.



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.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

Table IV Standard Normal Distribution Table

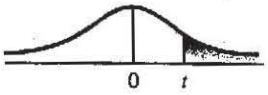
The entries in the table on this page give the cumulative area under the standard normal curve to the left of z with the values of z equal to 0 or negative.



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−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
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Table V The t Distribution Table

The entries in this table give the critical values of t for the specified number of degrees of freedom and areas in the right tail.



	Area in the Right Tail Under the t Distribution Curve					
df	.10	.05	.025	.01	.005	.001
1	3.078	6.314	12.706	31.821	63.657	318.309
2	1.886	2.920	4.303	6.965	9.925	22.327
3	1.638	2.353	3.182	4.541	5.841	10.215
4	1.533	2.132	2.776	3.747	4.604	7.173
5	1.476	2.015	2.571	3.365	4.032	5.893
6	1.440	1.943	2.447	3.143	3.707	5.208
7	1.415	1.895	2.365	2.998	3.499	4.785
8	1.397	1.860	2.306	2.896	3.355	4.501
9	1.383	1.833	2.262	2.821	3.250	4.297
10	1.372	1.812	2.228	2.764	3.169	4.144
11	1.363	1.796	2.201	2.718	3.106	4.025
12	1.356	1.782	2.179	2.681	3.055	3.930
13	1.350	1.771	2.160	2.650	3.012	3.852
14	1.345	1.761	2.145	2.624	2.977	3.787
15	1.341	1.753	2.131	2.602	2.947	3.733
16	1.337	1.746	2.120	2.583	2.921	3.686
17	1.333	1.740	2.110	2.567	2.898	3.646
18	1.330	1.734	2.101	2.552	2.878	3.610
19	1.328	1.729	2.093	2.539	2.861	3.579
20	1.325	1.725	2.086	2.528	2.845	3.552
21	1.323	1.721	2.080	2.518	2.831	3.527
22	1.321	1.717	2.074	2.508	2.819	3.505
23	1.319	1.714	2.069	2.500	2.807	3.485
24	1.318	1.711	2.064	2.492	2.797	3.467
25	1.316	1.708	2.060	2.485	2.787	3.450
26	1.315	1.706	2.056	2.479	2.779	3.435
27	1.314	1.703	2.052	2.473	2.771	3.421
28	1.313	1.701	2.048	2.467	2.763	3.408
29	1.311	1.699	2.045	2.462	2.756	3.396
30	1.310	1.697	2.042	2.457	2.750	3.385
31	1.309	1.696	2.040	2.453	2.744	3.375
32	1.309	1.694	2.037	2.449	2.738	3.365
33	1.308	1.692	2.035	2.445	2.733	3.356
34	1.307	1.691	2.032	2.441	2.728	3.348
35	1.306	1.690	2.030	2.438	2.724	3.340

Table V The *t* Distribution Table (continued)

	Area in the Right Tail Under the *t* Distribution Curve					
df	.10	.05	.025	.01	.005	.001
36	1.306	1.688	2.028	2.434	2.719	3.333
37	1.305	1.687	2.026	2.431	2.715	3.326
38	1.304	1.686	2.024	2.429	2.712	3.319
39	1.304	1.685	2.023	2.426	2.708	3.313
40	1.303	1.684	2.021	2.423	2.704	3.307
41	1.303	1.683	2.020	2.421	2.701	3.301
42	1.302	1.682	2.018	2.418	2.698	3.296
43	1.302	1.681	2.017	2.416	2.695	3.291
44	1.301	1.680	2.015	2.414	2.692	3.286
45	1.301	1.679	2.014	2.412	2.690	3.281
46	1.300	1.679	2.013	2.410	2.687	3.277
47	1.300	1.678	2.012	2.408	2.685	3.273
48	1.299	1.677	2.011	2.407	2.682	3.269
49	1.299	1.677	2.010	2.405	2.680	3.265
50	1.299	1.676	2.009	2.403	2.678	3.261
51	1.298	1.675	2.008	2.402	2.676	3.258
52	1.298	1.675	2.007	2.400	2.674	3.255
53	1.298	1.674	2.006	2.399	2.672	3.251
54	1.297	1.674	2.005	2.397	2.670	3.248
55	1.297	1.673	2.004	2.396	2.668	3.245
56	1.297	1.673	2.003	2.395	2.667	3.242
57	1.297	1.672	2.002	2.394	2.665	3.239
58	1.296	1.672	2.002	2.392	2.663	3.237
59	1.296	1.671	2.001	2.391	2.662	3.234
60	1.296	1.671	2.000	2.390	2.660	3.232
61	1.296	1.670	2.000	2.389	2.659	3.229
62	1.295	1.670	1.999	2.388	2.657	3.227
63	1.295	1.669	1.998	2.387	2.656	3.225
64	1.295	1.669	1.998	2.386	2.655	3.223
65	1.295	1.669	1.997	2.385	2.654	3.220
66	1.295	1.668	1.997	2.384	2.652	3.218
67	1.294	1.668	1.996	2.383	2.651	3.216
68	1.294	1.668	1.995	2.382	2.650	3.214
69	1.294	1.667	1.995	2.382	2.649	3.213
70	1.294	1.667	1.994	2.381	2.648	3.211
71	1.294	1.667	1.994	2.380	2.647	3.209
72	1.293	1.666	1.993	2.379	2.646	3.207
73	1.293	1.666	1.993	2.379	2.645	3.206
74	1.293	1.666	1.993	2.378	2.644	3.204
75	1.293	1.665	1.992	2.377	2.643	3.202
∞	1.282	1.645	1.960	2.326	2.576	3.090