KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS & STATISTICS
DHAHRAN, SAUDI ARABIA
STAT 211: BUSINESS STATISTICS I

Semester 101
Fainal Exam
Monday Jan 24, 2011
Allowed time 7:00 pm – 9:30 pm

Please **circle** your:

Instructor name	**section number**
Hassen A. Muttlak	Sec 4: (9:00 – 9:50) Sec 5 : (10:00 – 10:50)
Mohammad Saleh	Sec 2: (8:00 –8:50) Sec 3 : (9:00 – 9:50) Sec 6(11:00 – 11:50)

Name: Student ID#: Serial #:

Directions:

1) You must **show all work** to obtain full credit for questions on this exam.
2) **DO NOT round** your answers at each step. Round answers only if necessary at **your final step to 4 decimal places**.
3) You are allowed to use electronic calculators and other reasonable writing accessories that help write the exam. Try to define events, formulate problem and solve.
4) Do not keep your mobile with you during the exam, turn off your mobile and leave it aside

Question No	Full Marks	Marks Obtained
Q1	*10*	
Q2	*10*	
Q3	*8*	
Q4	*8*	
Q5	*12*	
Q6	*10*	
Q7	*10*	
Q8	*12*	
Total	*80*	

Question One (10 points)

Answer the following questions by marking True or False.

1. Statistical inference is the process of making an estimate, prediction, or decision about a population based on sample data _____

2. The possible responses to the question "How long have you been living at your current residence?" are values from a continuous variable _____

3. A statistic is usually unobservable while a parameter is usually observable _____

4. The difference between a histogram and a bar chart is that the histogram represents nominal data while the bar chart represents interval data._____

5. The largest value in a set of data is 140, and the lowest value is 70. If the resulting frequency distribution is to have five classes of equal width, the class width will be 14_____

6. A frequency distribution is a listing of the individual observations arranged in ascending or descending order._____

7. The intervals in a frequency distribution may overlap to ensure that each observation is assigned to an interval _____

8. The percentage distribution cannot be constructed from the frequency distribution directly._____

9. Using different frames to generate data can lead to totally different conclusions_____

10. A sample is selected by including everybody who sits in the first row of a business statistics class. This is an example of a cluster sample._____

Write all your choices in this table

Question number

1	2	3	4	5	6	7	8	9	10

Question Two (10 point)

Answer the following questions by circling the best answer.

The manager of the customer service division of a major consumer electronics company is interested in determining whether the customers who have purchased a videocassette recorder made by the company over the past 12 months are satisfied with their products.

Answer the questions from 1 to 3

1. The population of interest is
   a. all the customers who have bought a videocassette recorder made by the company over the past 12 months.
   b. all the customers who have bought a videocassette recorder made by the company and brought it in for repair over the past 12 months.
   c. all the customers who have used a videocassette recorder over the past 12 months.
   d. all the customers who have ever bought a videocassette recorder made by the company.
   e. None of the above.

2. The possible responses to the question "How much time do you spend watching TV every week on the average?" are values from a
   a. discrete numerical random variable.
   b. continuous numerical random variable.
   c. categorical random variable.
   d. parameter.
   e. None of the above.

3. The possible responses to the question "Out of a 10 point score with 10 being the highest and 0 being the lowest, what is your satisfaction level on the videocassette recorder that you purchased?" are values from a
   a. discrete numerical random variable.
   b. continuous numerical random variable.
   c. categorical random variable.
   d. parameter.
   e. None of the above.

4. The possible responses to the question "How many books that you bought from Jarir book store?" result in
   a. a nominal scale variable.
   b. an ordinal scale variable.
   c. an interval scale variable.
   d. a ratio scale variable.
   e. None of the above.

5. The manager decides to ask a sample of customers, who have bought a car, made by the company and filed a complaint over the past year, to fill in a survey about whether they are satisfied with the product. This method will most likely suffer from
   a. non-response error.
   b. measurement error.
   c. coverage error.
   d. non-probability sampling.
   e. None of the above.

6. If there are 4 different brands of cars made by the company, the best sampling strategy would be to use a
   a. a simple random sample.
   b. a stratified sample.
   c. a cluster sample.
   d. a systematic sample.
   e. None of the above.

7. You have collected data on the annual average amount of cash rebate offered by 6 different brands of automobiles sold in KSA in 2006 and 2007. Which of the following is the best for presenting the data?
   a. A contingency table.
   b. A stem-and-leaf display
   c. A time-series plot.
   d. A side-by-side bar chart.
   e. None of the above.

8. Which of the following is NOT a reason for the need for sampling?
   a) It is usually too costly to study the whole population.
   b) It is usually too time consuming to look at the whole population.
   c) It is sometimes destructive to observe the entire population.
   d) It is always more informative by investigating a sample than the entire population.
   e) None of the above.

9. The Dean of Students mailed a survey to a total of 400 students. The sample included 100 students randomly selected from each of the freshman, sophomore, junior, and senior classes on campus last term. What sampling method was used?
   a) Simple random sample
   b) Systematic sample
   c) Stratified sample
   d) Cluster sample
   e) All of the above.

10. A telemarketer set the company's computerized dialing system to contact every 25th person listed in the local telephone directory. What sampling method was used?
   a) Simple random sample
   b) Systematic sample
   c) Stratified sample
   d) Cluster sample
   e) All of the above.

Write all your choices in this table

Question number

1	2	3	4	5	6	7	8	9	10

Question Three (4+2+2 = 8 points)

A university dean is interested in determining the proportion of students who receive some sort of financial aid. Rather than examine the records for all students, the dean randomly selects 200 students and finds that 118 of them are receiving financial aid.

1. Develop and interpret a 90% confidence interval to estimate the true proportion of students who receive financial aid.

2. If a certain college at the university has 1345 students. Develop an interval to estimate the number of students who receive financial aid. Assume that all students will apply to get the financial aid.

3. If the dean wanted to estimate the proportion of all students receiving financial aid to within ±3% with 95% reliability, how many more students would need to be sampled?

Question Four (5+3 = 8 points)

A survey of 1,500 Canadians reveals that 945 believe that there is too much violence on television. In a survey of 1,500 Americans, 810 believe that there is too much television violence.

1. Estimate with 99% confidence the difference in the proportion of Canadians and Americans who believe that there is too much violence on television.

2. Briefly explain what the interval estimate in part (1) tells you.

Question Five (2+2+2+4+2 =12 points)

As an aid to the establishment of personnel requirements, the director of a hospital wishes to estimate the mean number of people who are admitted to the emergency room during a 24-hour period. The director randomly selects 25 different 24-hour periods and determines the number of admissions for each. The following numbers are recorded.

7	12	14	21	25	27	30	32	33	34	35	40	47
48	50	52	60	6	17	29	39	42	55	61	34	

1. Construct a stem – and – leaf plot.

2. Find the mean and the standard deviation for the number of people who are admitted to the emergency room during a 24-hour period.

3. Which assumption(s) is necessary in order for a confidence interval to be valid? Is the assumption valid? ***Explain***.

4. Estimate the mean number of admissions per 24-hour period with a 98% confidence interval.

5. Using the sample standard deviation as an estimate for the population standard deviation, what size sample should the director choose if she wishes to estimate the mean number of admissions per 24-hour period to within ±1 admission with 95% reliability,?

Question six (4+4+2 = 10 points)

There are different approaches to fitness training. To judge which one of two approaches is better, 200 twenty-five year old men are randomly selected to participate in an experiment. For four weeks, 120 men are trained by approach 1 while the other 80 men are trained by approach 2. The percentage improvement in fitness was measured for each man and the statistics shown below were computed. The percentage figures are known to be normally distributed.

Approach 1	Approach 2
$\bar{x}_1 = 27.3$	$\bar{x}_2 = 33.6$
$s_1^2 = 47.614$	$s_2^2 = 28.09$

1. Construct a 95% confidence interval for each method. ***And interpret your finding***.

2. Estimate with 93% confidence the difference in the mean percentage improvement between approaches 1 and 2, and ***briefly describe what this interval estimate tells you***.

3. Do these results in part (2) allow us to conclude at the 93% confidence that approach 2 is superior? ***Explain***.

Question Seven (2+5+3 =10 points)

A company claims that its medicine, Brand A, provides faster relief from pain than another company's medicine, Brand B. A researcher tested both brands of medicine on two groups of randomly selected patients.

The results of the test are given in the following table. The mean and standard deviation of relief times are given in minutes.

Brand	Sample Size	Mean Relief Times	Standard Deviation of Relief Times
A	23	44	11
B	19	49	9

You may not assume equal variance.

1. What the assumptions that you need to answer the following parts?

2. Construct a 90% confidence interval for the difference between the mean relief times for the two brands of medicine.

3. Do you agree with the company claims? Explain.

Question Eight (3 points each = 12 points)

Solve any 4 questions

1. The weekly sales at a bookstore have a mean of $50,000 and a standard deviation of $6,000. A sample of 36 weeks is selected, what is the probability the average weekly sale is more than $52,500?

2. The employees of a company were surveyed on questions regarding their educational background and marital status. Of the 600 employees, 400 had college degrees, 100 were single, and 60 were single college graduates. Find the probability that an employee of the company is married given that he has a college degree.

3. On the average, 1.8 customers per minute arrive at any one of the checkout counters of a grocery store. Find the probability that there will be no customer arriving at a checkout counter ten minutes?

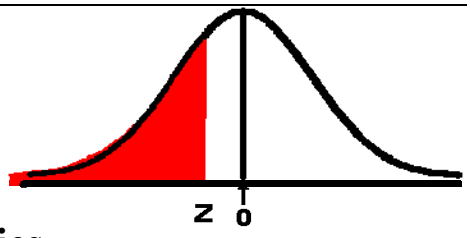
4. A debate team of 4 members for a high school will be chosen randomly from a potential group of 15 students. Ten of the 15 students have no prior competition experience while the others have some degree of experience. What is the probability that at most 1 of the members chosen for the team have some prior competition experience?

5. Suppose that past history shows that 60% of college students prefer Brand C cola. A sample of 5 students is to be selected. Find the probability that less than 2 prefer brand C.

6. A catalog company that receives the majority of its orders by telephone conducted a study to determine how long customers were willing to wait on hold before ordering a product. The length of time was found to be a random variable best approximated by an exponential distribution with a mean equal to 3 minutes. What proportion of callers is put on hold longer than 2.8 minutes?

The cumulative Standard Normal distribution

Entry represented area under the cumulative standardized normal distribution from - ∞ to Z

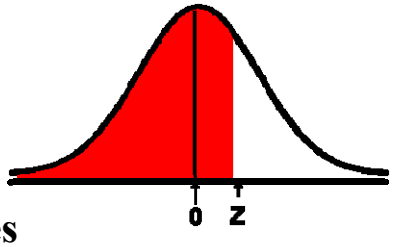


Cumulative Probabilities

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

The cumulative Standard Normal distribution

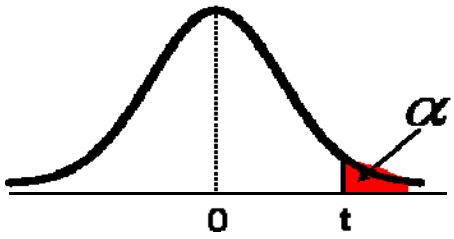
Entry represented area under the cumulative standardized normal distribution from - ∞ to Z



Cumulative Probabilities

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

For a particular number of degrees of freedom, entry represents the critical value of corresponding to a specified upper – tail area (α)



	Cumulative Probabilities									
	0.55	**0.65**	**0.75**	**0.85**	**0.9**	**0.95**	**0.965**	**0.975**	**0.99**	**0.995**
	Upper Tail Areas									
d.f.	**0.45**	**0.35**	**0.25**	**0.15**	**0.1**	**0.05**	**0.035**	**0.025**	**0.01**	**0.005**
1	0.1584	0.5095	1.0000	1.9626	3.0777	6.3138	9.0579	12.7062	31.8205	63.6567
2	0.1421	0.4447	0.8165	1.3862	1.8856	2.9200	3.5782	4.3027	6.9646	9.9248
3	0.1366	0.4242	0.7649	1.2498	1.6377	2.3534	2.7626	3.1824	4.5407	5.8409
4	0.1338	0.4142	0.7407	1.1896	1.5332	2.1318	2.4559	2.7764	3.7469	4.6041
5	0.1322	0.4082	0.7267	1.1558	1.4759	2.0150	2.2974	2.5706	3.3649	4.0321
6	0.1311	0.4043	0.7176	1.1342	1.4398	1.9432	2.2011	2.4469	3.1427	3.7074
7	0.1303	0.4015	0.7111	1.1192	1.4149	1.8946	2.1365	2.3646	2.9980	3.4995
8	0.1297	0.3995	0.7064	1.1081	1.3968	1.8595	2.0902	2.3060	2.8965	3.3554
9	0.1293	0.3979	0.7027	1.0997	1.3830	1.8331	2.0554	2.2622	2.8214	3.2498
10	0.1289	0.3966	0.6998	1.0931	1.3722	1.8125	2.0283	2.2281	2.7638	3.1693
11	0.1286	0.3956	0.6974	1.0877	1.3634	1.7959	2.0067	2.2010	2.7181	3.1058
12	0.1283	0.3947	0.6955	1.0832	1.3562	1.7823	1.9889	2.1788	2.6810	3.0545
13	0.1281	0.3940	0.6938	1.0795	1.3502	1.7709	1.9742	2.1604	2.6503	3.0123
14	0.1280	0.3933	0.6924	1.0763	1.3450	1.7613	1.9617	2.1448	2.6245	2.9768
15	0.1278	0.3928	0.6912	1.0735	1.3406	1.7531	1.9509	2.1314	2.6025	2.9467
16	0.1277	0.3923	0.6901	1.0711	1.3368	1.7459	1.9417	2.1199	2.5835	2.9208
17	0.1276	0.3919	0.6892	1.0690	1.3334	1.7396	1.9335	2.1098	2.5669	2.8982
18	0.1274	0.3915	0.6884	1.0672	1.3304	1.7341	1.9264	2.1009	2.5524	2.8784
19	0.1274	0.3912	0.6876	1.0655	1.3277	1.7291	1.9200	2.0930	2.5395	2.8609
20	0.1273	0.3909	0.6870	1.0640	1.3253	1.7247	1.9143	2.0860	2.5280	2.8453
21	0.1272	0.3906	0.6864	1.0627	1.3232	1.7207	1.9092	2.0796	2.5176	2.8314
22	0.1271	0.3904	0.6858	1.0614	1.3212	1.7171	1.9045	2.0739	2.5083	2.8188
23	0.1271	0.3902	0.6853	1.0603	1.3195	1.7139	1.9003	2.0687	2.4999	2.8073
24	0.1270	0.3900	0.6848	1.0593	1.3178	1.7109	1.8965	2.0639	2.4922	2.7969
25	0.1269	0.3898	0.6844	1.0584	1.3163	1.7081	1.8929	2.0595	2.4851	2.7874
26	0.1269	0.3896	0.6840	1.0575	1.3150	1.7056	1.8897	2.0555	2.4786	2.7787
27	0.1268	0.3894	0.6837	1.0567	1.3137	1.7033	1.8867	2.0518	2.4727	2.7707
28	0.1268	0.3893	0.6834	1.0560	1.3125	1.7011	1.8839	2.0484	2.4671	2.7633
29	0.1268	0.3892	0.6830	1.0553	1.3114	1.6991	1.8813	2.0452	2.4620	2.7564
30	0.1267	0.3890	0.6828	1.0547	1.3104	1.6973	1.8789	2.0423	2.4573	2.7500
32	0.1267	0.3888	0.6822	1.0535	1.3086	1.6939	1.8746	2.0369	2.4487	2.7385
34	0.1266	0.3886	0.6818	1.0525	1.3070	1.6909	1.8708	2.0322	2.4411	2.7284
36	0.1266	0.3884	0.6814	1.0516	1.3055	1.6883	1.8674	2.0281	2.4345	2.7195
38	0.1265	0.3882	0.6810	1.0508	1.3042	1.6860	1.8644	2.0244	2.4286	2.7116
40	0.1265	0.3881	0.6807	1.0500	1.3031	1.6839	1.8617	2.0211	2.4233	2.7045
42	0.1264	0.3880	0.6804	1.0494	1.3020	1.6820	1.8593	2.0181	2.4185	2.6981
44	0.1264	0.3878	0.6801	1.0488	1.3011	1.6802	1.8571	2.0154	2.4141	2.6923
46	0.1264	0.3877	0.6799	1.0483	1.3002	1.6787	1.8551	2.0129	2.4102	2.6870
48	0.1263	0.3876	0.6796	1.0478	1.2994	1.6772	1.8532	2.0106	2.4066	2.6822
50	0.1263	0.3875	0.6794	1.0473	1.2987	1.6759	1.8516	2.0086	2.4033	2.6778
60	0.1262	0.3872	0.6786	1.0455	1.2958	1.6706	1.8448	2.0003	2.3901	2.6603
70	0.1261	0.3869	0.6780	1.0442	1.2938	1.6669	1.8401	1.9944	2.3808	2.6479
80	0.1261	0.3867	0.6776	1.0432	1.2922	1.6641	1.8365	1.9901	2.3739	2.6387
90	0.1260	0.3866	0.6772	1.0424	1.2910	1.6620	1.8337	1.9867	2.3685	2.6316

Some Useful Formulas

- $S = \sqrt{\frac{\sum\left(x - \bar{x}\right)^2}{n-1}} = \sqrt{\frac{\sum x^2 - n(\bar{x})^2}{n-1}}$
- $P(A \text{ or } B) = P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A \cap B') = P(A) - P(A \cap B)$
- $P(A \mid B) = \frac{P(A \cap B)}{P(B)}$, $P(B) > 0$
- $P(A \cap B) = P(A) \times P(B \mid A) = P(B) \times P(A|B)$
- $P(B_j \mid A) = \frac{P(B_j \cap A)}{P(A)} = \frac{P(A|B_j)P(B_j)}{\sum_{i=1}^{k} P(A|B_i)P(B_i)}$ for $j = 1,2,\ldots,k$
- $P(x) = \frac{n!}{x!(n-x)!}\pi^x(1-\pi)^{n-x}$

  $\mu = E(X) = n\pi, \quad \sigma = \sqrt{n\pi(1-\pi)}$
- $P(x) = \frac{(\lambda t)^x e^{-\lambda t}}{x!}$, $\mu = \lambda t$, $\sigma = \sqrt{\lambda t}$
- $P(x) = \frac{C_{n-x}^{N-X} C_x^X}{C_n^N} = \frac{\binom{N-A}{n-x}\binom{A}{x}}{\binom{N}{n}}$
- $f(x) = \begin{cases} \frac{1}{b-a} & \text{if } a \le x \le b \\ 0 & \text{otherwise} \end{cases}$,

  $a \le c < d \le b \quad P(c \le X \le d) = (d-c)f(x)$
- $P(0 \le x \le a) = 1 - e^{-\lambda a}$
- $\mu_{\bar{x}} = \mu, \quad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$
- $\mu_{\bar{p}} = \pi$, $\sigma_{\bar{p}} = \sqrt{\frac{\pi(1-\pi)}{n}}$,
- $\bar{x} \pm z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$
- $\bar{x} \pm t_{\frac{\alpha}{2},n-1}\frac{s}{\sqrt{n}}$
- $n \ge \frac{z_{\alpha/2}^2 \sigma^2}{e^2} = \left(\frac{z_{\alpha/2}\,\sigma}{e}\right)^2$
- $\bar{p} \pm z_{\alpha/2}\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$
- $n \ge \frac{z_{\alpha/2}^2 \pi(1-\pi)}{e^2}$
- $\left(\bar{x}_1 - \bar{x}_2\right) \pm z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$
  - $\left(\bar{x}_1 - \bar{x}_2\right) \pm z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$
  - $\left(\bar{x}_1 - \bar{x}_2\right) \pm t_{\frac{\alpha}{2},n_1+n_2-2}\; s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$,

    where

    $s_p = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}}$
  - $\left(\bar{x}_1 - \bar{x}_2\right) \pm t_{\alpha/2,\,v}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$, where

    $v = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}}$
- $\bar{d} \pm t_{\frac{\alpha}{2},n-1}\frac{s_d}{\sqrt{n}}$
- $\left(\bar{p}_1 - \bar{p}_2\right) \pm z_{\alpha/2}\sqrt{\frac{\bar{p}_1(1-\bar{p}_1)}{n_1} + \frac{\bar{p}_2(1-\bar{p}_2)}{n_2}}$

  where

  $\bar{p}_1 = \frac{x_1}{n_1}, \qquad \bar{p}_2 = \frac{x_2}{n_2}$