

Math 1070
Exam 2

Name : _____

No outside materials allowed except pens or pencils and a calculator. You have all class period to finish the test. Remember to label all graphs, plots, and charts. SHOW ALL WORK.

Some things you might want to keep in mind :

$$\begin{array}{ll} \text{if } X \sim \text{binom}(n, p) \text{ then} & P\{X = k\} = \left(\frac{n!}{k!(n-k)!} \right) p^k (1-p)^{n-k} \\ \hat{p} \pm z \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} & \bar{x} \pm t \left(\frac{s}{\sqrt{n}} \right) \end{array}$$

1. Jeremy has to take the Math subject test for graduation. The math department uses this test as a comprehensive exam. Let X = Jeremy's score on the Math subject test, where $X \sim N(600, 15)$.
 - (a) **(15 points)** Jeremy needs to score in the 11th percentile to graduate. What score does he need to graduate?
 - (b) **(10 points)** Jeremy's brother (Steven) is taking the GMAT, let Y = Steven's score on the GMAT, where $Y \sim N(700, 12)$. Jeremy scores 624 on the math subject test and Steven scores 714 on the GMAT. Who is smarter?

2. Let X = the number of living grandparents that a randomly selected adult American has. According to the recent General Social Surveys, its probability distribution is approximately $P\{X = 0\} = 0.71, P\{X = 1\} = 0.15, P\{X = 2\} = 0.09, P\{X = 3\} = 0.03, P\{X = 4\} = 0.02$.
- (a) **(15 points)** Does this refer to a discrete, or a continuous, random variable? Why?
 - (b) **(15 points)** Show that the probabilities satisfy the two conditions for a probability distribution.
 - (c) **(20 points)** Find the mean (μ) of this probability distribution.

3. According to *Current Population Reports*, self-employed individuals in the United States work an average of 44.6 hours per week, with a standard deviation of 14.5. If this variable is approximately normally distributed,
- (a) **(10 points)** Sketch a graph of the normal distribution and mark the following points
 - i. 44.6
 - ii. 40
 - iii. the region that represents working more than 40 hours a week.
 - (b) **(15 points)** Find the proportion of the self-employed who work more than 40 hours per week.

4. When the 2000 GSS asked subjects whether they would be willing to accept cuts in their standard of living to protect the environment, 344 of 1170 subjects said yes.
- (a) **(10 points)** Estimate the population proportion who would answer yes.
 - (b) **(15 points)** Find the standard error for this proportion.
 - (c) **(15 points)** Find a 95% confidence interval for the proportion of subjects who answered 'yes' and interpret.
 - (d) **(10 points)** State and check the assumptions needed for the interval in (c) to be valid.

5. The following final sales prices were reported for the Palm M515 on eBay

212, 249, 250, 240, 210, 230, 195, 193.

- (a) **(15 points)** Find the point estimate of μ .
- (b) **(20 points)** If $s = 23.03$, find the standard error.
- (c) **(15 points)** Find the 95% confidence interval for this data and interpret it in context.

6. A football team has probability 0.50 of winning any particular game. In a season, it plays six conference games.
- (a) **(10 points)** Using the binomial distribution, identify n and p .
 - (b) **(20 points)** Find the probability that the team wins three of its conference games.
 - (c) **(20 points)** What are the assumptions when we use the binomial distribution? Name one that might be violated in this problem.

[illegible]

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.00034	0.00032	0.00031	0.00030	0.00029	0.00028	0.00027	0.00026	0.00025	0.00024
-3.3	0.00048	0.00047	0.00045	0.00043	0.00042	0.00040	0.00039	0.00038	0.00036	0.00035
-3.2	0.00069	0.00066	0.00064	0.00062	0.00060	0.00058	0.00056	0.00054	0.00052	0.00050
-3.1	0.00097	0.00094	0.00090	0.00087	0.00084	0.00082	0.00079	0.00076	0.00074	0.00071
-3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00104	0.00100
-2.9	0.00187	0.00181	0.00175	0.00169	0.00164	0.00159	0.00154	0.00149	0.00144	0.00139
-2.8	0.00256	0.00248	0.00240	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193
-2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.00280	0.00272	0.00264
-2.6	0.00466	0.00453	0.00440	0.00427	0.00415	0.00402	0.00391	0.00379	0.00368	0.00357
-2.5	0.00621	0.00604	0.00587	0.00570	0.00554	0.00539	0.00523	0.00508	0.00494	0.00480
-2.4	0.00820	0.00798	0.00776	0.00755	0.00734	0.00714	0.00695	0.00676	0.00657	0.00639
-2.3	0.01072	0.01044	0.01017	0.00990	0.00964	0.00939	0.00914	0.00889	0.00866	0.00842
-2.2	0.01390	0.01355	0.01321	0.01287	0.01255	0.01222	0.01191	0.01160	0.01130	0.01101
-2.1	0.01786	0.01743	0.01700	0.01659	0.01618	0.01578	0.01539	0.01500	0.01463	0.01426
-2.0	0.02275	0.02222	0.02169	0.02118	0.02068	0.02018	0.01970	0.01923	0.01876	0.01831
-1.9	0.02872	0.02807	0.02743	0.02680	0.02619	0.02559	0.02500	0.02442	0.02385	0.02330
-1.8	0.03593	0.03515	0.03438	0.03362	0.03288	0.03216	0.03144	0.03074	0.03005	0.02938
-1.7	0.04457	0.04363	0.04272	0.04182	0.04093	0.04006	0.03920	0.03836	0.03754	0.03673
-1.6	0.05480	0.05370	0.05262	0.05155	0.05050	0.04947	0.04846	0.04746	0.04648	0.04551
-1.5	0.06681	0.06552	0.06426	0.06301	0.06178	0.06057	0.05938	0.05821	0.05705	0.05592
-1.4	0.08076	0.07927	0.07780	0.07636	0.07493	0.07353	0.07215	0.07078	0.06944	0.06811
-1.3	0.09680	0.09510	0.09342	0.09176	0.09012	0.08851	0.08691	0.08534	0.08379	0.08226
-1.2	0.11507	0.11314	0.11123	0.10935	0.10749	0.10565	0.10383	0.10204	0.10027	0.09853
-1.1	0.13567	0.13350	0.13136	0.12924	0.12714	0.12507	0.12302	0.12100	0.11900	0.11702
-1.0	0.15866	0.15625	0.15386	0.15151	0.14917	0.14686	0.14457	0.14231	0.14007	0.13786
-0.9	0.18406	0.18141	0.17879	0.17619	0.17361	0.17106	0.16853	0.16602	0.16354	0.16109
-0.8	0.21186	0.20897	0.20611	0.20327	0.20045	0.19766	0.19489	0.19215	0.18943	0.18673
-0.7	0.24196	0.23885	0.23576	0.23270	0.22965	0.22663	0.22363	0.22065	0.21770	0.21476
-0.6	0.27425	0.27093	0.26763	0.26435	0.26109	0.25785	0.25463	0.25143	0.24825	0.24510
-0.5	0.30854	0.30503	0.30153	0.29806	0.29460	0.29116	0.28774	0.28434	0.28096	0.27760
-0.4	0.34458	0.34090	0.33724	0.33360	0.32997	0.32636	0.32276	0.31918	0.31561	0.31207
-0.3	0.38209	0.37828	0.37448	0.37070	0.36693	0.36317	0.35942	0.35569	0.35197	0.34827
-0.2	0.42074	0.41683	0.41294	0.40905	0.40517	0.40129	0.39743	0.39358	0.38974	0.38591
-0.1	0.46017	0.45620	0.45224	0.44828	0.44433	0.44038	0.43644	0.43251	0.42858	0.42465
-0.0	0.50000	0.49601	0.49202	0.48803	0.48405	0.48006	0.47608	0.47210	0.46812	0.46414

Cumulative Probabilities for the t Distribution

Confidence Level	0.80	0.90	0.95	0.98	0.99	0.998
df	$t_{0.1}$	$t_{0.05}$	$t_{0.025}$	$t_{0.01}$	$t_{0.005}$	$t_{0.001}$
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
40	1.303	1.684	2.021	2.423	2.704	3.307
50	1.299	1.676	2.009	2.403	2.678	3.261
60	1.296	1.671	2.000	2.390	2.660	3.232
80	1.292	1.664	1.990	2.374	2.639	3.195
100	1.290	1.660	1.984	2.364	2.626	3.174
∞	1.282	1.645	1.960	2.326	2.576	3.091