Fall 2019 Exam I

STAT 8010-003

September 27, 2019

Name:_____

Directions

1. Show your work on ALL questions (except those multiple choice questions). Unsupported work will NOT receive full credit.
2. Decimal answers should be exact, or to exactly 4 significant digits.
3. Please write legibly. If I cannot read your writing, NO credit will be given.
4. You are allowed the following aids:
   (a) a one-page A4 handwritten cheat sheet
   (b) A scientific Calculator
   (c) Pencils or pens
5. Turn off your cell phone before the exam begins.

Use your time wisely. Good Luck!!!

Problem	Points Possible	Points Earned
1	8	
2	12	
3	20	
4	20	
5	20	
Total	80	

Problem 1

Fill in the blank with the *capital* letter associated with the word from the following list that *best* illustrates the given scenario. **(2 points for each answer.)**

A. Boxplot	B. Simple Random Sample	C. Stratified Sample	D. Convenience Sample
E. Cluster Sample	F. Probability Sample	G. Time series	H. Cross-sectional
I. Nominal	J. Ordinal	K. Experimental	L. Observational

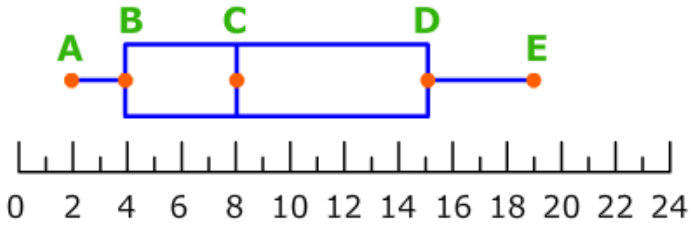
(a) Likert scale questions typically have answers like very dissatisfied, dissatisfied, neutral, satisfied, and very satisfied. This is a (J) Ordinal, qualitative variable.

(b) Daily temperatures in Clemson from 1950-2015 is a (G) Time series data set.

(c) Noah divided the animal kingdom into species and gender, then randomly picked 1 from each combination. What sampling technique did he use? (C) Stratified Sample

(d) A scientist tries his weight loss drug on a group of monkeys with identical diets. 60 monkeys are randomly assigned to either get the drug or not get the drug (30 in each group). The weight gained/lost was recorded for each monkey. This is an (K) Experimental study.

Problem 2



Use the boxplot above to answer the following questions **(3 points for each answer.)**

(a) What does the labeled point C represent on the boxplot plot?

A : Mean

B : Median

C : Mode

D : Range

(b) What do the labeled points B and D represent on the boxplot?

A : Mean and Mode

B : Median and Mode

C : Least and Greatest value

D : Lower and Upper quartile

(c) What is the maximum value of the data set?

A : 8

B : 11

C : 15

D : 19

(d) If we replace the maximum value by 38, which of the following statistics WILL NOT change?

A : Range

B : Mean

C : Variance

D : IQR

Problem 3

Use the data pertaining to marital status and gender to calculate the following probabilities. **(5 points for each answer.)**

	Married	Single	Divorced/Widowed	Total
Men	55	100	45	200
Women	90	35	25	150
Total	145	135	70	350

(a) What percent of the individuals were male?

$\frac{200}{350} = 57.14\%$

(b) What percent of the individuals were male and married?

$\frac{55}{350} = 15.71\%$

(c) What percent of the men were single?

$\frac{100}{200} = 50\%$

(d) What percent of the married individuals were male?

$\frac{55}{145} = 37.93\%$

Problem 4

Event A: Rolling at least one six in 4 throws of a die
Event B: Rolling at least one double six in 24 throws of a pair of dice

(a) Let X be the number of six in 4 throws of a die and Y be the number of double six in 24 throws of a pair of dice, State the distribution and parameters for X and Y, respectively. **(10 points)**

$X \sim \text{Bin}(n = 4, p = 1/6)$
$Y \sim \text{Bin}(n = 24, p = 1/36)$

(b) Compute $\mathbb{E}[X]$ and $\mathbb{E}[Y]$. **(5 points)**

$\mathbb{E}[X] = 4 \times 1/6 = 2/3 = 0.6667$
$\mathbb{E}[Y] = 24 \times 1/36 = 2/3 = 0.6667$

(c) Compute the probability of event A and event B. Which event is more likely to occur? **(5 points)**

$\mathbb{P}(A) = 1 - \mathbb{P}(A^c) = 1 - \binom{4}{0}(\frac{1}{6})^0(\frac{5}{6})^4 = 1 - 0.4823 = 0.5177$

$\mathbb{P}(B) = 1 - \mathbb{P}(B^c) = 1 - \binom{24}{0}(\frac{1}{36})^0(\frac{35}{36})^{24} = 1 - 0.5086 = 0.4914$

$\Rightarrow$ Event A is more likely to occur.

Problem 5

Denver Downs has a large pumpkin patch, where the weight of the pumpkins follows a normal distribution with an average of 14 pounds, and a standard deviation of 4 pounds. Each pumpkin's weight is independent of all other pumpkins.

(a) What is the probability that a randomly selected pumpkin weighs over 16 pounds? **(7 points)**

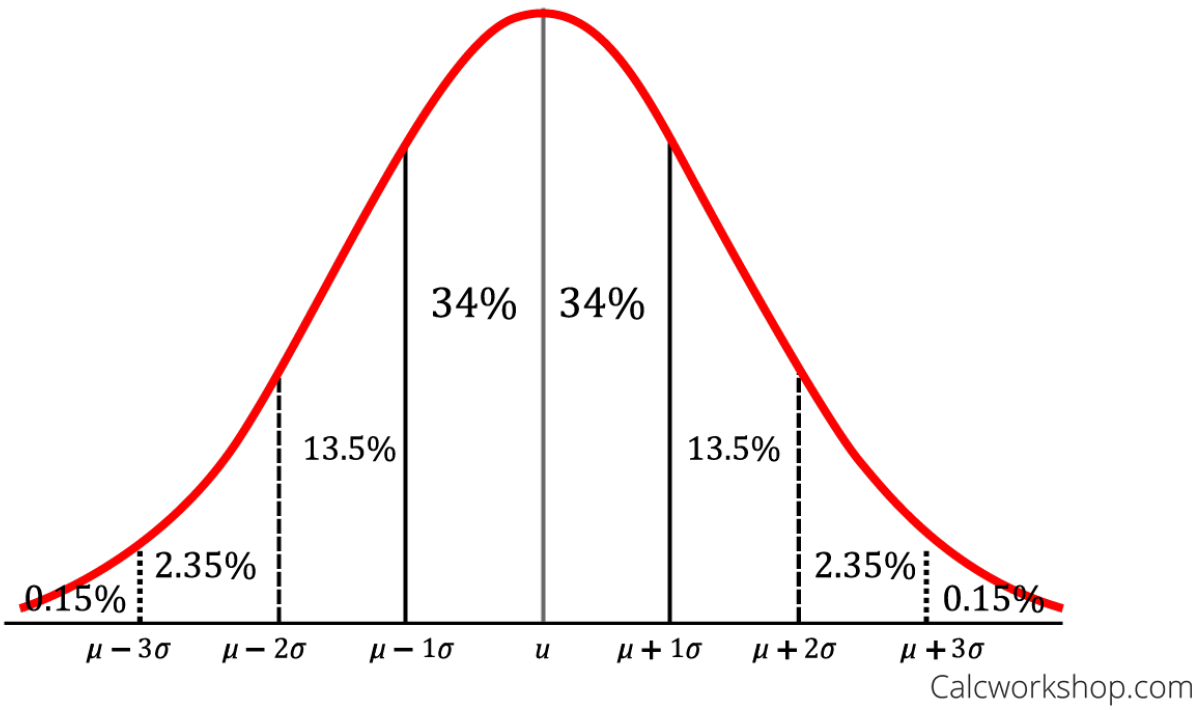
Let X be the weight of a randomly selected pumpkin. $X \sim \mathrm{N}(\mu = 14, \sigma = 4)$

$$\begin{aligned}\mathbb{P}(X > 16) &= \mathbb{P}(Z > (16-14)/4) = \mathbb{P}(Z > 0.5) \\ &= 1 - \mathbb{P}(Z \leq 0.5) = 1 - \Phi(0.5) \\ &= 1 - 0.69146 = 0.30854\end{aligned}$$

(b) What is the probability that a randomly selected pumpkin weighs over 16 pounds given that the selected pumpkin weighs over 14 pounds? **(7 points)**

$$\begin{aligned}\mathbb{P}(X > 16 | X > 14) &= \frac{\mathbb{P}(X > 16)}{\mathbb{P}(X > 14)} \\ &= \frac{1 - \Phi(0.5)}{1 - \Phi(0)} \\ &= \frac{0.30854}{0.5} = 0.61708\end{aligned}$$

(c) Using the empirical rule to find the cutoff for the top 2.5% of pumpkin weights at Denver Downs. **(6 points)**



Based on the empirical rule, the top 2.5% percentile is $\mu + 2\sigma = 14 + 2 \times 4 = 22$lbs.

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414
-0.1	.46017	.45620	.45224	.44828	.44433	.44034	.43640	.43251	.42858	.42465
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-1	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08692	.08534	.08379	.08226
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-2	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-3	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-4	.00003	.00003	.00003	.00003	.00003	.00003	.00002	.00002	.00002	.00002

1.1 – Negative Z Table

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
+0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
+0.1	.53983	.54380	.54776	.55172	.55567	.55966	.56360	.56749	.57142	.57535
+0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
+0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
+0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
+0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
+0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
+0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
+0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
+0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
+1	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
+1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
+1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
+1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91308	.91466	.91621	.91774
+1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
+1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
+1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
+1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
+1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
+1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
+2	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
+2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
+2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
+2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
+2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
+2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
+2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
+2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
+2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
+2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
+3	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
+3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
+3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
+3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
+3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
+3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
+3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
+3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
+3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
+3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997
+4	.99997	.99997	.99997	.99997	.99997	.99997	.99998	.99998	.99998	.99998

1.2 – Positive Z Table