## STA248H1: Statistics for Computer Scientists - Midterm Exam

## July 23, 2018, 6:10 pm- 9:00 pm

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## Instructions:

- You have <u>180 minutes</u> for <u>5 questions</u> with multiple parts. You may open the test once the start has been announced.
- You may use a calculator. For a numerical answer, please round it off to 3 decimal digits.
- Total pages (including the cover): 19.
- Write your answers in the given space only. You cannot use blank space for other questions nor can you write answers on the back. Your entire answer must fit in the designated space provided immediately after each question.

Formula or information you might need can be found on the last page.

Question	Q1	<b>Q2</b>	Q3	<b>Q</b> 4	$\mathbf{Q5}$	Total
Points	20	10	20	25	25	100
Score						

Formula or tables:

- The p.d.f of a normal random variable X with mean  $\mu$  and variance  $\sigma^2$ :  $f_X(x) = \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ .
- The p.m.f of a binomial random variable  $X \sim B(n, p)$  with probability of success in a single trial p and the number of the trial n is:

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

•  $Y = (n-1)S^2/\sigma^2 \sim \chi^2(n-1)$  has mean n-1 and variance 2(n-1) where  $S^2 = \sum_{i=1}^n (X_i - \bar{X})^2/n$ 

Ζ	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	0.9924	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	0.9958	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

## Table A.5 Critical Values for t Distributions



α									
•	.10	.05	.025	.01	.005	.001	.0005		
1	3.078	6.314	12.706	31.821	63.657	318.31	636.62		
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598		
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924		
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610		
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869		
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959		
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408		
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041		
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781		
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587		
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437		
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318		
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221		
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140		
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073		
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015		
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965		
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922		
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883		
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850		
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819		
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792		
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767		
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745		
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725		
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707		
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690		
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674		
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659		
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646		
32	1.309	1.694	2.037	2.449	2.738	3.365	3.622		
34	1.307	1.691	2.032	2.441	2.728	3.348	3.601		
36	1.306	1.688	2.028	2.434	2.719	3.333	3.582		
38	1.304	1.686	2.024	2.429	2.712	3.319	3.566		
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551		
50	1.299	1.676	2.009	2.403	2.678	3.262	3.496		
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460		
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373		
00	1 282	1.645	1 960	2 326	2 576	3,090	3 291		