UNIVERSITY OF TORONTO
Faculty of Arts and Science

August 2018 EXAMINATIONS

STA248H1S

Duration - 3 hours

Examination Aids: Scientific Calculator

STA248H1S
Summer 2018
Final Exam
17/08/2018
Time Limit: 3 hours

Last Name (Print): _____

First Name (Print): _____

Student Number: _____

This exam contains 18 pages (including this cover page) and 5 problems. Check to see if any pages are missing. Enter all requested information on the top of this page.

- This is a closed-book exam. You are only allowed to use a scientific calculator and the formulae from the last page of the exam.
- ANOVA stands for 'Analysis of Variance';
  MLE stands for 'Maximum Likelihood Estimator';
  MSE stands for 'Mean Squared Error';
- You are required to show your work on each problem on this exam. Please carry all possible precision through a numerical question, and give your final answer to three (3) decimals, unless they are trailing zeroes or otherwise indicated.
- You may use a benchmark of $\alpha = 5\%$ for all inference, unless otherwise indicated.

Problem	Points	Score
1	20	
2	25	
3	15	
4	15	
5	25	
Total:	100	

Additional information and formula:

$$\Phi^{-1}(0.75) = 0.674,\ \Phi^{-1}(0.80) = 0.842,\ \Phi^{-1}(0.85) = 1.036;$$

$$\Phi^{-1}(0.925) = 1.439,\ \Phi^{-1}(0.95) = 1.645,\ \Phi^{-1}(0.995) = 2.576.$$

Mean and variance of $Y \sim \chi^2(n-1)$ are $n-1$ and $2(n-1)$, respectively.
Mean and variance of $Y \sim \text{Binom}(n,p)$ are np and $np(1-p)$, respectively.

$$Z_{\text{d}} = \frac{\bar{X}_1 - \bar{X}_2 + (\mu_1 - \mu_2)}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}}$$

$$S_{\text{p}} = \sqrt{((n_1-1)S_1^2 + (n_2-1)S_2^2)/(n_1+n_2-2)}$$

$$T = \frac{\bar{X}_1 - \bar{X}_2 + (\mu_1 - \mu_2)}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}} \qquad T = \frac{\bar{X}_1 - \bar{X}_2 + (\mu_1 - \mu_2)}{\sqrt{S_1^2/n_1 + S_2^2/n_2}}$$

$$F = \frac{MST}{MSE} = \frac{\sum_{i=1}^{k} n_i(\bar{X}_i - \bar{X})^2/(k-1)}{\sum_{i=1}^{k}\sum_{j=1}^{n_i}(X_{ij} - \bar{X}_i)^2/(N-k)}$$

$$R^2 = \frac{\sum_{i=1}^{n}(\hat{a} + \hat{b}X_i - \bar{Y})^2}{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}$$

$$b = \frac{\Sigma(X_i - \bar{X})(Y_i - \bar{Y})}{\Sigma(X_i - \bar{X})^2} = \frac{\Sigma X_i Y_i - n\bar{X}\bar{Y}}{\Sigma X_i^2 - n\bar{X}^2} \qquad a = \bar{Y} - b\bar{X}$$

$$Var(b) = \frac{\sigma^2}{\Sigma(X_i - \bar{X})^2} \qquad Var(a) = \sigma^2\left(\frac{1}{n} + \frac{\bar{X}^2}{\Sigma(X_i - \bar{X})^2}\right)$$

$$r_{X,Y} = \frac{\Sigma(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\Sigma(X_i - \bar{X})^2 \Sigma(Y_i - \bar{Y})^2}}$$

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	0.9924	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

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