Name:

STAT 270

Final Examination

Instructions: This is a closed book test but you are allowed four sheets of US letter sized paper with as much on them as you want. You may use a calculator but not a computer or a phone. Your work will be marked for clarity of explanation. Explain what assumptions you are making and comment if those assumptions seem unreasonable. I want the answers written on the paper. I have provided a normal table and a t-table at the end of the exam before the grading sheet. The exam is out of **52**.

1. I have two 4 sided dice – one red, one green. Each has the 4 sides labelled 1, 2, 3, and 4. When I toss one of these dice one side ends up face down and the number on the face down side is the one I have tossed.

   (a) If I toss the two dice what is the sample space? [1 mark]

   (b) In the previous problem what is the event that the sum of the two numbers tossed is 4? [1 mark]

   (c) Let A be the event that the sum of the two numbers tossed is 4 and B be the event that the sum of the two numbers tossed is even (one of 2, 4, 6, or 8, that is). Find $P(A|B)$ and $P(B|A)$. [2 marks]

2. The continuous random variable X has density

$$f(x) = \begin{cases} \frac{x+a}{2} & 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

(a) What is a? [1 mark]

(b) What is the cumulative distribution function of X? Sketch your answer. [1 mark]

(c) What is the variance of X? [2 marks]

3. A random sample of 400 eligible voters in Surrey is drawn. Of these 185 say they will vote yes on the transit referendum. An independent sample of 600 eligible voters in Vancouver gives 200 who say they will vote yes. Give a 90% confidence interval for the difference between the two cities in the true proportions of eligible voters who support the referendum. [3 marks]

4. Using the same numbers as in the previous question test the hypothesis that there is no difference in voting intentions between the two municipalities. [3 marks]

5. We generally assume that when a coin is tossed it lands heads up with prob ability 0.5. It has been suggested, however, that if you do the experiment in a different way the chance might change. One such way is to stand the coin on edge on a hard flat surface, hold it upright with a finger and then flick the edge with a finger to send the coin spinning away.

   A group of 107 statistics students actually did this, 40 times each for a total of 4280 spins.

   (a) Suppose they got a total of 2376 heads. Give a 99% confidence interval for the probability that spinning produces heads. [3 marks]

   (b) Is it reasonable to believe that this method produces heads with probability 1/2? [3 marks]

6. When soft drink bottles are filled there is some variability in the volume of liquid put in. A regulator samples 21 bottles from a day's production of 500 ml bottles and gets a sample mean of 498.8 ml with a sample standard deviation of 2.1ml. Is there clear evidence that the population mean is below the required value of 500 ml? [3 marks]

7. A regulator requires the average concentration of a certain contaminant in a tin of fish to be below 100 parts per billion (ppb). A sample of 9 tins made by one firm shows an average of 110 ppb. The sample standard deviation is 12 ppb. At the 5% level should we reject the hypothesis that the firms production is at or below the standard of 100 ppb? Your answer will include a statement of the assumptions you must make. [2 marks]

Normal Cumulative Distribution Function

z	$F(z)$	z	$F(z)$	z	$F(z)$	z	$F(z)$	z	$F(z)$
0.00	0.5000	0.41	0.6591	0.82	0.7939	1.23	0.8907	1.68	0.9535
0.01	0.5040	0.42	0.6628	0.83	0.7967	1.24	0.8925	1.72	0.9573
0.02	0.5080	0.43	0.6664	0.84	0.7995	1.25	0.8944	1.76	0.9608
0.03	0.5120	0.44	0.6700	0.85	0.8023	1.26	0.8962	1.80	0.9641
0.04	0.5160	0.45	0.6736	0.86	0.8051	1.27	0.8980	1.84	0.9671
0.05	0.5199	0.46	0.6772	0.87	0.8078	1.28	0.8997	1.88	0.9699
0.06	0.5239	0.47	0.6808	0.88	0.8106	**1.282**	**0.900**	**1.920**	**0.972**
0.07	0.5279	0.48	0.6844	0.89	0.8133	1.29	0.9015	1.96	0.9750
0.08	0.5319	0.49	0.6879	0.90	0.8159	1.30	0.9032	2.00	0.9772
0.09	0.5359	0.50	0.6915	0.91	0.8186	1.31	0.9049	2.04	0.9793
0.10	0.5398	0.51	0.6950	0.92	0.8212	1.32	0.9066	2.08	0.9812
0.11	0.5438	0.52	0.6985	0.93	0.8238	1.33	0.9082	2.12	0.9830
0.12	0.5478	0.53	0.7019	0.94	0.8264	1.34	0.9099	2.16	0.9846
0.13	0.5517	0.54	0.7054	0.95	0.8289	1.35	0.9115	2.20	0.9861
0.14	0.5557	0.55	0.7088	0.96	0.8315	1.36	0.9131	2.24	0.9875
0.15	0.5596	0.56	0.7123	0.97	0.8340	1.37	0.9147	2.28	0.9887
0.16	0.5636	0.57	0.7157	0.98	0.8365	1.38	0.9162	2.32	0.9898
0.17	0.5675	0.58	0.7190	0.99	0.8389	1.39	0.9177	**2.326**	**0.990**
0.18	0.5714	0.59	0.7224	1.00	0.8413	1.40	0.9192	2.36	0.9909
0.19	0.5753	0.60	0.7257	1.01	0.8438	1.41	0.9207	2.40	0.9918
0.20	0.5793	0.61	0.7291	1.02	0.8461	1.42	0.9222	2.44	0.9927
0.21	0.5832	0.62	0.7324	1.03	0.8485	1.43	0.9236	2.48	0.9934
0.22	0.5871	0.63	0.7357	1.04	0.8508	1.44	0.9251	2.52	0.9941
0.23	0.5910	0.64	0.7389	1.05	0.8531	1.45	0.9265	2.56	0.9948
0.24	0.5948	0.65	0.7422	1.06	0.8554	1.46	0.9279	**2.576**	**0.995**
0.25	0.5987	0.66	0.7454	1.07	0.8577	1.47	0.9292	2.60	0.9953
0.26	0.6026	0.67	0.7486	1.08	0.8599	1.48	0.9306	2.64	0.9959
0.27	0.6064	0.68	0.7517	1.09	0.8621	1.49	0.9319	2.68	0.9963
0.28	0.6103	0.69	0.7549	1.10	0.8643	1.50	0.9332	2.72	0.9967
0.29	0.6141	0.70	0.7580	1.11	0.8665	1.51	0.9345	2.76	0.9971
0.30	0.6179	0.71	0.7611	1.12	0.8686	1.52	0.9357	2.80	0.9974
0.31	0.6217	0.72	0.7642	1.13	0.8708	1.53	0.9370	2.84	0.9977
0.32	0.6255	0.73	0.7673	1.14	0.8729	1.54	0.9382	2.88	0.9980
0.33	0.6293	0.74	0.7704	1.15	0.8749	1.55	0.9394	2.92	0.9982
0.34	0.6331	0.75	0.7734	1.16	0.8770	1.56	0.9406	2.96	0.9985
0.35	0.6368	0.76	0.7764	1.17	0.8790	1.57	0.9418	3.00	0.9987
0.36	0.6406	0.77	0.7794	1.18	0.8810	1.58	0.9429	3.04	0.9988
0.37	0.6443	0.78	0.7823	1.19	0.8830	1.59	0.9441	3.08	0.9990
0.38	0.6480	0.79	0.7852	1.20	0.8849	1.60	0.9452	3.12	0.9991
0.39	0.6517	0.80	0.7881	1.21	0.8869	**1.645**	**0.950**	3.16	0.9992
0.40	0.6554	0.81	0.7910	1.22	0.8888	1.64	0.9495	∞	1.0000

Table B1: Student t critical points

left tail prob	0.800	0.900	0.950	0.975	0.990	0.995	0.999
right tail prob	0.200	0.100	0.050	0.025	0.010	0.005	0.001
ν							
1	1.376	3.078	6.314	12.706	31.821	63.657	318.309
2	1.061	1.886	2.920	4.303	6.965	9.925	22.327
3	0.978	1.638	2.353	3.182	4.541	5.841	10.215
4	0.941	1.533	2.132	2.776	3.747	4.604	7.173
5	0.920	1.476	2.015	2.571	3.365	4.032	5.893
6	0.906	1.440	1.943	2.447	3.143	3.707	5.208
7	0.896	1.415	1.895	2.365	2.998	3.499	4.785
8	0.889	1.397	1.860	2.306	2.896	3.355	4.501
9	0.883	1.383	1.833	2.262	2.821	3.250	4.297
10	0.879	1.372	1.812	2.228	2.764	3.169	4.144
12	0.873	1.356	1.782	2.179	2.681	3.055	3.930
14	0.868	1.345	1.761	2.145	2.624	2.977	3.787
16	0.865	1.337	1.746	2.120	2.583	2.921	3.686
18	0.862	1.330	1.734	2.101	2.552	2.878	3.610
20	0.860	1.325	1.725	2.086	2.528	2.845	3.552
22	0.858	1.321	1.717	2.074	2.508	2.819	3.505
24	0.857	1.318	1.711	2.064	2.492	2.797	3.467
26	0.856	1.315	1.706	2.056	2.479	2.779	3.435
28	0.855	1.313	1.701	2.048	2.467	2.763	3.408
30	0.854	1.310	1.697	2.042	2.457	2.750	3.385
35	0.852	1.306	1.690	2.030	2.438	2.724	3.340
40	0.851	1.303	1.684	2.021	2.423	2.704	3.307
50	0.849	1.299	1.676	2.009	2.403	2.678	3.261
60	0.848	1.296	1.671	2.000	2.390	2.660	3.232
80	0.846	1.292	1.664	1.990	2.374	2.639	3.195
∞	0.842	1.282	1.645	1.960	2.326	2.576	3.090

Final Exam Grade Sheet

Name: Student Number:

1a		1	1b		1
1c		2	2		?
4		2	5		2
			Total		12