AMS 102 Section 4 FINAL EXAM **FORM B**

12/13/2011

Instructions:

There is a total of **100 possible points** in this exam + a **bonus** question of up to **10 points**.

PLEASE SHOW ALL WORK. Credit WILL NOT be given if a reasonable amount of work is not shown and partial credit cannot be awarded unless work is shown.

You are **ALLOWED** to use any **NOTES** or the **BOOK** from the class during the exam, as well as a **CALCULATOR**.

NO CELL PHONES OR COMPUTERS.

You will be given **2:30** mins to complete the exam. I will provide updates to time on the board.

Take your time, try your best. **GOOD LUCK!!!**

DO ALL WORK ON A SEPARATE SHEET and bring those with you when you turn in the exam.

NAME: _____

ID: _____

1) (5 points) **CALCULATE** the **SAMPLE STANDARD DEVIATION** of the following sample data. Note that the mean of the observations is 6 and the sum of the observations is 48.

5 7 6 10 3 2 4 11

---

2) (5 points) Consider a **Discrete Uniform Random Variable** between and including **0** and **3**. This is where the probability of all integers in the range are the same, ie P(0) = P(1) = P(2) = P(3). **What is the common probability of each**?

---

3) (30 points) A study is being performed on the IQ of kids who placed out of 6th grade math at a middle school. It is a **generally accepted belief** that all **IQs are normally distributed** with a **mean of 100** and **a variance of 225**. A **sample of 9 students** was taken and their IQs are listed below.

115 130 145 105 125 108 105 135 112

a) (3 points) What is the **SAMPLE MEAN** of the observed IQ scores?

b) (10 points) Create a **95% CONFIDENCE INTERVAL** for the mean IQ score of the kids.

c) (5 points) Explain what it means to be 95% Confident, ie **what is happening with a probability of 95%**?

d) (4 points) Is **the assumption that** the sample mean is distributed normally **met** in this situation?

e) (8 points) A higher level of confidence is requested but they want to maintain approximately a margin of error not too far from the current one found. If the **CONFIDENCE LEVEL** is ***INCREASED TO 99%***, what should be the **NEW SAMPLE SIZE** used to obtain a **MARGIN OF ERROR** of **9**.

4) (40 points) You are trying to determine if a previous study which claimed that 65% of students go home for thanksgiving break was biased to underestimate the true value. So you want to conduct your own study to determine if 65% is too low of a value.

0 'YES'	10 'YES'	20 'YES'	30 'YES'	40 'NO'	50 'YES'	60 'YES'	70 'YES'	80 'YES'	90 'YES'
1 'NO'	11 'YES'	21 'YES'	31 'NO'	41 'YES'	51 'NO'	61 'YES'	***71 'YES'***	***81 'YES'***	91 'YES'
2 'YES'	***12 'YES'***	22 'NO'	32 'YES'	42 'NO'	52 'YES'	62 'YES'	72 'YES'	82 'YES'	92 'NO'
3 'YES'	13 'YES'	23 'YES'	33 'YES'	43 'YES'	53 'YES'	63 'NO'	73 'YES'	***83 'YES'***	93 'YES'
4 'YES'	14 'NO'	24 'YES'	34 'YES'	44 'YES'	54 'YES'	64 'YES'	74 'YES'	84 'YES'	94 'YES'
5 'YES'	15 'YES'	25 'YES'	35 'YES'	45 'NO'	55 'NO'	65 'YES'	***75 'YES'***	85 'YES'	95 'YES'
6 'NO'	16 'NO'	26 'YES'	36 'YES'	46 'YES'	***56 'YES'***	***66 'YES'***	76 'NO'	86 'YES'	96 'YES'
7 'YES'	17 'YES'	27 'YES'	***37 'YES'***	47 'NO'	***57 'YES'***	67 'YES'	77 'YES'	87 'YES'	97 'NO'
8 'YES'	18 'YES'	28 'YES'	38 'YES'	48 'YES'	58 'YES'	68 'YES'	78 'NO'	88 'YES'	98 'YES'
9 'YES'	19 'NO'	29 'NO'	39 'YES'	49 'YES'	59 'NO'	69 'NO'	79 'YES'	89 'YES'	***99 'NO'***

a) (4 points) What are you **Null** and **Alternative Hypotheses**?

b) (4 points) You want to conduct a **Simple Random Sample without replacement** from the above population. You are randomly selecting 16 observations, and I have selected the first 12 for you below**. Finish the sampling procedure** using **Row 9** of the attached **Random Number Table**.

3	6	12	37	56	57	66	71
75	81	83	99	_	_	_	_

c) (4 points) Now **CALCULATE** your observed sample statistic $\hat{p}$.

d) (5 points) You are asked to test at the 5% level. Recall that 5% = α = Probability of a Type I error**. Interpret what a Type I error is in this situation**.

e) (7 points) Calculate your **TEST STATISTIC** for this hypothesis test.

f) (5 points) Calculate the **P-VALUE** for the test statistic you found in part e).

g) (6 points) Based on your p-value and α = 5%, what is your **DECISION**? Provide an **INTERPRETATION** of your results.

h) (5 points) In order for this test to be valid, we assume that $\hat{p} \sim Normal$.

Our check for this is that $np > 5$ $n(1-p) > 5$ which are satisfied.

Multiple values for $\hat{p}$ given a sample size of 16 are provided below. Since our assumptions are valid, they should show evidence of a normal distribution. **Given the data provided below, CONSTRUCT A HISTOGRAM** of $\hat{p}$ values and **COMMENT** on whether or not you can infer if $\hat{p}$ does **FOLLOW A NORMAL DISTRIBUTION** with a sample size of 16.

Range of $\hat{p}$ values	Frequency
$04375 \leq \hat{p} < 0.50$	1
$0.50 \leq \hat{p} < 0.5625$	3
$0.5625 \leq \hat{p} < 0.625$	4
$0.625 \leq \hat{p} < 0.6875$	10
$0.6875 \leq \hat{p} < 0.75$	7
$0.75 \leq \hat{p} < 0.8125$	3
$0.8125 \leq \hat{p} < 0.875$	2

---

5) (20 points) Consider the operation of opening a new business. Assume that some possible outcomes of your business are considered as events.

Event A: Your company makes a profit within the first 5 years

Event B: Your company goes out of business within the first 5 years

Event C: Your company is purchased by a competitor within the first 5 years

And the probabilities associated with these events are as follows.

$$\boldsymbol{P(A) = 0.55} \qquad \boldsymbol{P(B) = 0.60} \qquad \boldsymbol{P(C) = 0.30}$$

a) (6 points) Based on the probabilities above, **IS IT POSSIBLE** that events ***A*** and ***B*** are **MUTUALLY EXCLUSIVE**? **Why or why not**?

b) (4 points) You are provided additional information that $\boldsymbol{P(A \mid C) = 0.70}$. **What is the probability that your company makes a profit *AND* is purchased by a competitor within the first 5 years**?

c) (4 points) Are the events ***A*** and ***C*** **INDEPENDENT**? **Why or why not**?

d) (6 points) What is the probability that your company doesn't make a profit within the first 5 years ***AND*** your company isn't purchased by a competitor within the first five years. (Hint: this is asking for the **complement of** $\boldsymbol{P(A \cup C)}$.)

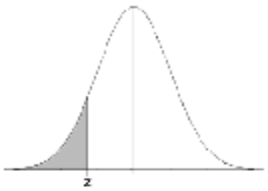
Bonus Question (Up to 10 points)

PICK ONE of the following topics and tell me everything you know about it.

a) **Binomial Random Variables** b) **Bias in Sampling**
c) **Experimental Design** d) **Boxplots and Modified Boxplots**

Line \ Col.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	10460	15011	01536	02011	81647	91646	69179	14194	62590	36207	20969	99570	91291	90700
2	22368	46573	25595	85393	30995	89198	27982	53402	93965	34095	52666	19174	39615	99505
3	24130	48360	22527	97265	76393	64809	15179	24830	49340	32081	30680	19655	63348	58629
4	42167	93093	06243	61680	07856	16376	39440	53537	71341	57004	00849	74917	97758	16379
5	37570	39975	81837	16656	06121	91782	60468	81305	49684	60672	14110	06927	01263	54613
6	77921	06907	11008	42751	27756	53498	18602	70659	90655	15053	21916	81825	44394	42880
7	99562	72905	56420	69994	98872	31016	71194	18738	44013	48840	63213	21069	10634	12952
8	96301	91977	05463	07972	18876	20922	94595	56869	69014	60045	18425	84903	42508	32307
9	89579	14342	63661	10281	17453	18103	57740	84378	25331	12566	58678	44947	05585	56941
10	85475	36857	53342	53988	53060	59533	38867	62300	08158	17983	16439	11458	18593	64952
11	28918	69578	88231	33276	70997	79936	56865	05859	90106	31595	01547	85590	91610	78188
12	63553	40961	48235	03427	49626	69445	18663	72695	52180	20847	12234	90511	33703	90322
13	09429	93969	52636	92737	88974	33488	36320	17617	30015	08272	8411	27156	30613	74952
14	10365	61129	87529	85689	48237	52267	67689	93394	01511	26358	85104	20285	29975	89868
15	07119	97336	71048	08178	77233	13916	47564	81056	97735	85677	29372	74461	28551	90707
16	51085	12765	51821	51259	77452	16308	60756	92144	49442	53900	70960	63990	75601	40719
17	02368	21382	62404	60268	89368	19885	55322	44819	01188	65255	64835	44919	05944	55157
18	01011	54092	33362	94904	31273	04146	18594	29852	71585	85030	51132	01915	92747	64951
19	52162	53916	46369	58586	23216	14513	83149	98736	23495	64350	94738	17752	35156	35749
20	07056	97628	33787	09998	42698	06691	76988	13602	51851	46104	88916	19509	25625	58104
21	48663	91245	85826	14346	09172	30168	90229	04734	59193	22178	30421	61666	99904	32812
22	54164	58492	00421	74103	47070	25306	76468	26384	58151	06646	21524	15227	96909	44592
23	32639	32363	05597	24200	13363	38005	94342	28728	35806	06912	17012	64161	18296	22851
24	29334	27001	87637	87308	58731	00256	45834	15398	46557	41135	10367	07684	36188	18510
25	02488	33062	28834	07351	19731	92420	60952	61280	50001	67658	32586	86679	50720	94953
26	81525	72295	04839	96423	24878	82651	66566	14778	76797	14780	13300	87074	79666	95725
27	29676	20591	68086	26432	46901	20849	89768	81536	86645	12659	92259	57102	80428	25280
28	00742	57392	39064	66432	84673	40027	32832	61362	98947	96067	64760	64584	96096	98253
29	05366	04213	25669	26422	44407	44048	37937	63904	45766	66134	75470	66520	34693	90449
30	91921	26418	64117	94305	26776	25940	39972	22209	71500	64568	91402	42416	07844	69618
31	00582	04711	87917	77341	42206	35126	74087	99547	81817	42607	43808	76655	62028	76630
32	00725	69884	62797	56170	86324	88072	76222	36086	84637	93161	76038	65855	77919	88006
33	69011	65795	95876	55293	18988	27354	26575	08625	40801	59920	29841	80150	12777	48501
34	25976	57948	29888	88604	67917	48708	18912	82271	65424	69774	33611	54262	85963	03547
35	09763	83473	73577	12908	30883	18317	28290	35797	05998	41688	34952	37888	38917	88050
36	91567	42595	27958	30134	04024	86385	29880	99730	00036	84855	29080	09250	79656	73211
37	17955	56349	90999	49127	20044	59931	06115	20542	18059	02008	73708	83517	36103	42791
38	46503	18584	18845	49618	02304	51038	20655	58727	28168	15475	56942	53389	20562	87338
39	92157	89634	94824	78171	84610	82834	09922	25417	44137	48413	25555	21246	35509	20468
40	14577	62765	35605	81263	39667	47358	56873	56307	61607	45918	89686	20103	77490	18062
41	98427	07523	00062	64270	01638	92477	66969	98420	04880	45585	46565	04102	46880	45709
42	34914	63976	88720	82765	34476	17032	87589	40836	32427	70002	70663	88863	77775	69348
43	70060	28277	39475	46473	23219	53416	94970	25832	69975	94884	19661	72828	00102	66794
44	53976	54914	06990	67245	68350	82948	11398	42878	80287	88267	47363	46634	06541	97809
45	76072	29515	40980	07391	58745	25774	00987	80059	39911	96189	41151	14222	60697	59583
46	90725	52210	83974	29992	65831	38857	50490	83765	55657	14361	31720	57375	56228	41546
47	64364	67412	33339	31926	14883	24413	59744	92351	97473	89286	35931	04110	23726	51900
48	08962	00358	31662	25388	61642	34072	81249	35648	56891	69352	48373	45578	78547	81788
49	95012	68379	93526	70765	10592	04542	76463	54328	02349	17247	28865	14777	62730	92277
50	15664	10493	20492	38391	91132	21999	59516	81652	27195	48223	46751	22923	32261	85653

Standard Normal Cumulative Probability Table



Cumulative probabilities for NEGATIVE z-values are shown in the following table:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641