UNIVERSITY AT ALBANY
STATE UNIVERSITY OF NEW YORK

AMAT 108 Elementary Statistics
Fall 2024

Exam 2
Version A

Print Name:

UAlbany Email:

Directions: You have **80 minutes** to answer the following questions. For all multiple-choice questions, select **one** answer from among the choices given. No explanation is required to be shown, and no partial credit will be given. Make sure to **completely** fill in the circle corresponding to your chosen answer.

For all free-response questions, you **must** show all necessary work to receive full credit. An answer with no work, even if correct, will not receive full credit. Please circle or box your final answer. All work, if needed, is to be rounded to **at least five** decimal places.

No notes, textbooks, mobile phones, or other aids are allowed. Only scientific calculators are allowed. **Do not detach these pages.**

Please indicate your section with a check mark (✓) in the left-most column.

✓	Section	Instructor Name	Meeting Time	Meeting Days	Meeting Location
	1724	Douglas Rosenberg	3:00PM	T/TH	ES 140
	1725	James Lamatina	12:00PM	T/TH	LC 25
	1726	John Racquet	3:00PM	M/W	LC 2
	3414	Chris Lange	4:30PM	T/TH	HU 132
	3807	Tung Lam	11:40AM	M/W	HU 129
	3808	Luciano Medina	10:30AM	T/TH	ES 144
	3809	James Lamatina	9:00AM	T/TH	HU 124
	4551	Tung Lam	8:00AM	M/W	ES 140
	4803	Peter Young	9:00AM	T/TH	ES 139
	4960	Peter Young	12:00PM	T/TH	ES 140
	5574	Chris Lange	3:00PM	T/TH	SS 133

Exam Scoring:

Page	Possible Points	Points Earned
3	4	
4	17	
5	17	
6	13	
7	10	
Total Points	61	
Percentage		

Questions 1-3 are based on the following: Suppose we are given that $P(H) = 0.59$, $P(K) = 0.37$, and $P(H \cap K) = 0.1784$.

1. Find $P(K^C)$. (1 pt.)

   ① 0.37
   ② 0.59
   ③ 0.63
   ④ 0.41
   ⑤ None of the previous options.

2. Find $P(H \cup K)$, given that events H and K are mutually exclusive (disjoint). (1 pt.)

   ① 0
   ② 0.96
   ③ 0.2183
   ④ 0.22
   ⑤ 0.8216

3. Find $P(K|H)$. (1 pt.)

   ① 0.6271
   ② 0.48216
   ③ 1.59459
   ④ 0.37
   ⑤ 0.30237

4. Using the standard normal curve, find $P(-2.38 \leq Z \leq 0.17)$. (1 pt.)

   ① 0.5588
   ② 0.0054
   ③ 0.0136
   ④ -2.21
   ⑤ 0.9864

5. From a sample of 150 people that drive to work, 116 of them drive alone. Compute the following probabilities and **round all answers to four decimal places, if necessary**.
   (a) The first worker drives to work alone. (3 pts.)

   (b) The second worker drives to work alone, **given** that the first worker drives to work alone. Assume we are **sampling without replacement**. (3 pts.)

   (c) The second worker drives to work alone, **given** that the first worker does not drive to work alone. Assume we are **sampling without replacement**. (2 pts.)

   (d) None of four workers drive to work alone when **sampling with replacement**. (3 pts.)

   (e) At least one of four workers drives to work alone when **sampling with replacement**. (3 pts.)

6. Suppose the probability that a person is between 15 and 24 years of age is 0.132. Also suppose the probability that a person is between 15 and 24 years of age and spends at least 60 minutes online per day is 0.086. Compute the probability that a person spends at least 60 minutes online per day, given that they are between 15 and 24 years of age. **Round your answer to four decimal places.** (3 pts.)

7. A probability distribution of a discrete random variable X is given below:

X	4	9	15
Probability	0.62	0.31	0.07

(a) Find the mean (expected value) of the discrete random variable X. **Do not round your answer.** (3 pts.)

(b) Find the standard deviation of the discrete random variable X. **Round your answer to three decimal places.** (5 pts.)

8. Suppose Y is a continuous random variable that follows a uniform distribution from $y = 15$ to $y = 67$ (the interval is $(15, 67)$).

(a) Find the height of the density curve. **Leave your answer in fractional form.** (2 pts.)

(b) Compute $P(Y \leq 20)$. **Round your answer to three decimal places.** (3 pts.)

9. In 2011, the average wait time at a drive-in window of a local bank is 10.3 minutes with a standard deviation of 2.7 minutes. Assuming the distribution is approximately normal, what is the cut-off wait time at the drive-in window that represents the 74^{th} percentile (lowest 74%)? **Round your answer to two decimal places.** (4 pts.)

10. A college financial aid advisor claims that the mean cost of textbooks per semester for all students is \$601 with a standard deviation of approximately \$95. Assume a random sample of 80 students from this college is selected.
    (a) Is the distribution of $\overline{X}$ normal? (1 pt.)

    ① No, and we cannot conclude anything about the distribution of $\overline{X}$.

    ② No, but the distribution is approximately normal because the sample size is large enough.

    ③ Yes, because the population has a normal distribution with mean \$601 and standard deviation \$95.

    (b) Find the mean and the standard deviation of the sampling distribution of $\overline{X}$. **Round the standard deviation to five decimal places.** (4 pts.)

    (c) Find the z-score for a sample mean of \$590. **Round your answer to two decimal places.** (3 pts.)

    (d) Find $P(\overline{X} < 590)$. (1 pt.)

    (e) Find $P(590 < \overline{X} < 612)$. **Note:** This is an example of symmetric limits. (4 pts.)

11. A recent study indicated that 27% of all Americans read several times a week. Assume a random sample of 130 Americans is selected.
    (a) Is the distribution of $\hat{p}$ normal? (1 pt.)

    ① No, and we cannot conclude anything about the distribution of $\hat{p}$.

    ② Yes, because the population of interest has a normal distribution.

    ③ No, but $\hat{p}$ has an approximate normal distribution because the success-failure conditions are met.

    ④ No, but $\hat{p}$ has an approximate normal distribution because the sample size is large enough.

    (b) Find the mean and standard deviation of the sampling distribution of $\hat{p}$. **Round the standard deviation to five decimal places.** (4 pts.)

    (c) Find the z-score for a sample proportion of 0.32. **Round your answer to two decimal places.** (3 pts.)

    (d) Find $P(\hat{p} > 0.32)$. (2 pts.)

Formula Sheet:

- Probability:

$$P(A \cup B) = P(A \text{ or } B) = P(A) + P(B) \text{ if events } A \text{ and } B \text{ are disjoint}$$
$$P(A \cap B) = P(A \text{ and } B) = P(A)P(B) \text{ if events } A \text{ and } B \text{ are independent}$$

- Complement probability (probability complement rule): $P(A^C) = P(\text{not } A) = 1 - P(A)$

- At least 1 Rule: $P(\text{at least 1 success in } n \text{ trials}) = 1 - P(\text{no successes in } n \text{ trials})$

- Finding the height of a uniform distribution:

$$\text{Height} = \frac{1}{\text{Base}} = \frac{1}{b-a}$$

- Probability (area) of a uniform distribution: Probability (or area) = Base $\cdot$ Height

- Mean and standard deviation of discrete random variable X with possible values $x_1, x_2, \ldots, x_n$:

$$\mu_X = E(X) = x_1p(x_1) + x_2p(x_2) + \cdots + x_np(x_n)$$
$$\sigma_X = \sqrt{(x_1-\mu_X)^2p(x_1) + (x_2-\mu_X)^2p(x_2) + \cdots + (x_n-\mu_X)^2p(x_n)} = \sqrt{E(X^2) - (E(X))^2}$$

- Mean and standard deviation for sampling distribution of $\overline{X}$:

$$\mu_{\overline{X}} = \mu \qquad\qquad \sigma_{\overline{X}} = \frac{\sigma}{\sqrt{n}}$$

  where μ = population mean and σ = population standard deviation

- Standardized variable (z-score) for $\overline{X}$ (when σ known):

$$Z = \frac{\overline{X} - \mu}{\left(\frac{\sigma}{\sqrt{n}}\right)}$$

- Mean and standard deviation for sampling distribution of $\hat{p}$:

$$\mu_{\hat{p}} = p \qquad\qquad \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

- Standardized variable (z-score) for $\hat{p}$:

$$Z = \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}}$$

- Success/failure condition for the sampling distribution of $\hat{p}$ to be approximately normal:

$$np \geq 10 \qquad\qquad n(1-p) \geq 10$$

Standard Normal Table

Table Values Represent Area to the Left of the z-score

z^*	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−3.90	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
−3.80	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.70	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.60	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.50	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
−3.40	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.30	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.20	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.10	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.00	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.90	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.80	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.70	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.60	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.50	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.40	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.30	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.20	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.10	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.00	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.90	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.80	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.70	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.60	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.50	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.40	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.30	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.20	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.10	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.00	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.90	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.80	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.70	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.60	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.50	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.40	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.30	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.20	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.10	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.00	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

Standard Normal Table

Table Values Represent Area to the Left of the z-score

z^*	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.00	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.10	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.20	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.30	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.40	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.50	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.60	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.70	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.80	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.90	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.00	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.10	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.20	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.30	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.40	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.50	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.60	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.70	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.80	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.90	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.00	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.10	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.20	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.30	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.40	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.50	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.60	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.70	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.80	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.90	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.00	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.10	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.20	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.30	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.40	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.50	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.60	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.70	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.80	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.90	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000