

This exam lasts 2 hours. Please silence and put away your cell phone. You are allowed 1 sheet of notes (front and back) and a calculator. Show enough work that it is clear how you arrived at your answer. Decimal answers should be rounded to 4 decimal points. Put a box around your final answer to each question. Good luck!

1. Consider the following sets.

$$A = \{0, 3, 6, 9, 12\}$$

$$B = \{0, 2, 4, 6, 8, 10, 12\}$$

(a) (6 points) True or false:

i. $0 \in A$

iii. $0 \subseteq A$

v. $\{4, 8, 10\} \in B$

ii. $\emptyset \in A$

iv. $\emptyset \subseteq A$

vi. $\{4, 8, 10\} \subseteq B$

(b) (2 points) What elements belong to $A \cap B$?

(c) (2 points) What elements belong to $A \cup B$?

2. A small school has a baseball team, a soccer team, and football team. However, the school has only 50 students. Thus, many students play more than one sport.

- 19 students play baseball
- 21 students play soccer
- 23 students play football
- 11 students play baseball and soccer
- 13 students play soccer and football
- 10 students play all three sports
- 13 students play no sports

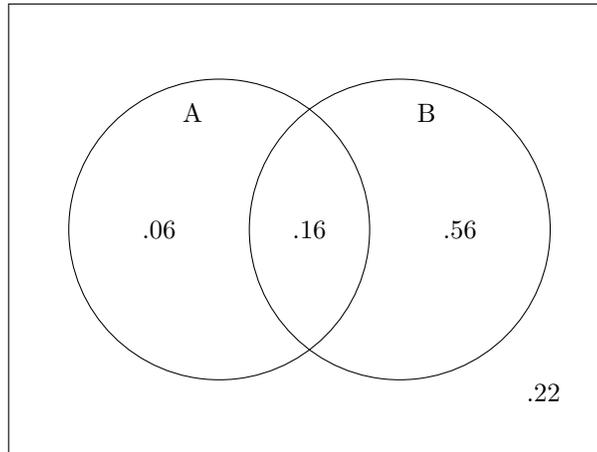
(a) (2 points) How many students play only soccer?

(b) (2 points) How many students play soccer and football, but not baseball?

(c) (2 points) How many students play baseball and football?

3. An experiment can result in events A , B , both A and B , or neither with the following probabilities.
(Note: the chart and the Venn diagram are equivalent.)

	A	A'
B	.16	.56
B'	.06	.22



- (a) (3 points) Find $P(A)$.
- (b) (3 points) Find $P(A|B)$.
- (c) (3 points) Are A and B independent? Why or why not?
4. (a) (3 points) How many ways are there for a 12 member committee to choose a president, vice-president, and secretary?
- (b) (3 points) How many ways are there for a 12 member committee to choose 5 members to serve on a subcommittee?

5. (6 points) Suppose you randomly select 6 animals from a group of 8 lions, 11 tigers, and 16 bears. What is the probability that you select exactly 2 lions, 2 tigers, and 2 bears?

6. (6 points) Suppose a test for certain disease is said to be 99% accurate for the following reasons.

- If a person has the disease, the probability that they will test positive is .99.
- If a person does not have the disease, the probability that they will test negative (i.e. not positive) is .99.

If the probability that a person has the disease is only .005, find the probability that a person who tests positive for the disease actually has the disease.

7. (6 points) If you roll a regular die (faces: 1, 2, 3, 4, 5, 6) 20 times, what is the probability of rolling a six exactly 4 times?

8. A raffle is being held in which 2,000 tickets are sold for \$10 each. There is 1 top prize of \$5,000, 4 middle prizes of \$500 each, and 10 lower prizes of \$100 each. All other tickets receive no prize (\$0). Let x equal the net gain/loss from buying one ticket, that is

$$x = \text{prize money} - 10.$$

(a) (4 points) Describe the probability distribution $p(x)$ by filling in the chart below.

x		
$p(x)$		

(b) (4 points) Calculate the expected value $E(x)$ for x .

9. Consider the following set of data.

80 91 53 53 46 25 92 48 7

(a) (2 points) Compute the mean \bar{x} , and show how you arrived at your answer.

(b) (2 points) Compute the median.

(c) (2 points) Compute the mode.

(d) (2 points) Compute the range.

10. Let z be a random variable with the standard normal probability distribution ($\mu = 0$, $\sigma = 1$). Use the table provided at the end of the exam or a calculator to answer the following questions.

(a) (3 points) Find the probability $P(z \leq -0.83)$

(b) (3 points) Find the probability $P(z \geq 1.44)$

(c) (3 points) Determine the value z_0 such that $P(z \leq z_0) = .281$.

(d) (3 points) Determine the value z_0 such that $P(z \geq z_0) = .011$.

11. Suppose that the weight of chicken eggs is normally distributed with a mean $\mu = 2.03$ oz and standard deviation of $\sigma = .24$ oz.

(a) (5 points) Chicken eggs that weight between 2.15 oz and 2.35 oz are labelled “Extra Large” by the USDA. What percentage of all chicken eggs could be labelled “Extra Large”?

(b) (5 points) How much does a chicken egg need to weigh in order to be heavier than 99% of all chicken eggs?

12. (5 points) If you deposit \$1,800 into an account earning 2.3% annual interest compounded quarterly, find the account balance (i.e. *compound amount*) after 3.5 years.

13. Suppose you currently owe your credit card company \$4,215 and you are being charged 27% annual interest compounded monthly on the amount owed.

(a) (5 points) Find the monthly *periodic payment* necessary to amortize the loan and pay off your credit card debt in 12 equal-sized monthly payments.

(b) (3 points) Using your answer to part (a), what is the total amount of all payments made, and what is the total interest paid?

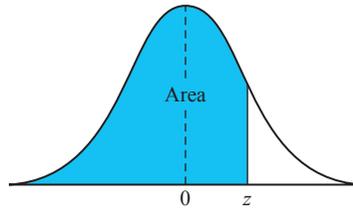


TABLE 3 Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0017	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0722	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

