Exam 2 Review
Math 118 Sections 1 and 2

This exam will cover sections 2.4, 2.5, 3.1-3.3, 4.1-4.3 and 5.1-5.2 of the textbook. No books, notes, calculators or other aids are allowed on this exam. There is no time limit. The exam will consist of 25 multiple choice questions. All exam questions will have the option 'None of the above', but when writing the exam, we intend to always include the correct answer in the other options. This means 'None of the above' will be a correct answer only if there is a typo or similar type mistake.

It is important that you know the terms, notations and formulas in the book. Some exam questions will test definitions, notations, or knowledge of basic facts of equations directly. The questions on this review that test the basics are marked with a B. There are a disproportionate number of basic questions on this review, because almost all problems require the knowledge of this basic information. Most exam questions will mimic homework problems, as much as possible considering the homework is free response and the exam is multiple choice. Finally, up to 20% of exam questions will be what I call extension questions. See the last page for a description and examples of extension questions.

The review questions included are not all possible types of questions. They are just representative of the types of questions that could be asked to test the given concept.

The following are the concepts which will be tested on this exam.

A.1 Know the conditions for a probability question to be a binomial experiment (p.99). Know the formula (p.100) for how to compute a binomial probability, and be able to use it to find binomial probabilities. (Section 2.4)

1. Which of the following is NOT a characteristic of a Bernoulli trial (or binomial experiment) with success having probability $p > 0$?

   (a) There are only two possible outcomes, success and failure.
   (b) The same experiment is repeated a fixed number of times.
   (c) The probability of success does not change on subsequent trials.
   (d) For n trials, the expected value of the number of successes is np
   (e) For n trials, $P(X = 2) = C(n, 2)p^2$
   (f) None of the Above

2. An unfair coin which lands on heads with probability $p = \frac{2}{3}$ is flipped 4 times. What is the probability that there are exactly 2 heads?

   (a) $\frac{8}{27}$
   (b) $\frac{4}{9}$
   (c) $\frac{16}{27}$
   (d) $\frac{1}{2}$
   (e) $\frac{4}{27}$
   (f) None of the Above

3. Six students will decide if they are on a committee by flipping a fair coin. Each student flips the coin and is on the committee if they flip a head. What is the probability that the committee has at least two members, but does not consist of all six students?

(a) $\dfrac{15}{64}$

(b) $\dfrac{29}{32}$

(c) $\dfrac{25}{32}$

(d) $\dfrac{57}{64}$

(e) $\dfrac{7}{8}$

(f) None of the Above

A.2 Know the definition of random variable. Know the formula for expected value of a random variable (p.110). Be able to calculate expected value for a variety of random variables (i.e. using probability distribution, lottery, raffle, p.114:19-26). Know the definition of fair game and be able to determine when a game is fair (p.111). Know the formula for expected value of a binomial probability (p.113). (Section 2.5)
* Probabilities other than binomial probabilites are not tested directly on this exam, but it is possible that you will be asked to compute probabilities in order to determine expected value.

A.3 We also learned how to create and read probability histograms, but these topics will NOT be tested on the exam. (Section 2.5)

4. Compute the expected value of X given the table

x	$P(X = x)$
-3	1/4
0	1/3
1	1/6
2	1/4

(a) 1/12

(b) 1/4

(c) 1

(d) -1/12

(e) -1/4

(f) None of the above.

5. An unfair coin which lands on *heads* with probability $p = \frac{3}{4}$ is flipped 12 times. If X is a random variable representing the number of tails flipped, find $E(X)$.

(a) 3

(b) 9

(c) $\left(\dfrac{3}{4}\right)^{12}$

(d) 6

(e) 4

(f) None of the above

6. Bob's hamburger restaurant buys some hamburger patties infected with e-coli. The probability that the e-coli survives cooking at Bob's is 0.3. If 100 patties are cooked, what is the expected number of patties which will have no living e-coli after cooking?

   (a) 15
   (b) 30
   (c) 70
   (d) 85
   (e) 100
   (f) None of the above.

7. You pay \$6 to play a game in which you roll a fair die. If you roll a 6, you get \$8. If you roll a 5, you get \$7. For any other number, you get \$4. What are your expected net winnings?

   (a) $-\$1.11$
   (b) $-\$0.83$
   (c) \$7.66
   (d) \$6.33
   (e) -\$0.33
   (f) None of the above

8. There are 10 apples in the fridge and 2 of them are bad. If you grab 3 apples, what is the expected number of bad apples?

   (a) $\frac{17}{45}$
   (b) $\frac{2}{5}$
   (c) $\frac{3}{5}$
   (d) $\frac{11}{30}$
   (e) $\frac{8}{15}$
   (f) None of the above

A.4 Be able to compute mean, median and mode for a random sample or a frequency distribution. Be able to compute the mean of a grouped distribution. (3.1)

A.5 In this section we also discussed frequency histograms and frequency polygons, and the concepts of sample mean versus population mean, etc. These concepts will NOT be tested on this exam. (3.1)

9. (B) Find the median and mode of the numbers: 15, 16, 18, 20, 18, 17

   (a) median: 17, mode 18
   (b) median: 18, mode: 17
   (c) median 17.5, mode 18
   (d) median: 18, mode: 15
   (e) median: 18, mode: 17.5
   (f) None of the above.

10. In a survey, 20 mall shoppers are asked their ages. Eight of the shoppers are between 16 and 24, six are between 25 and 35, two are between 36 and 40, and four are between the ages of 41 and 65. Calculate the mean age of shoppers for this grouped sample.

   (a) 35.125
   (b) 25.7
   (c) 27.2
   (d) 36.9
   (e) 31.4
   (f) None of the above.

11. Find the mean for the given frequency distribution:

x	f
-3	2
0	4
1	3
2	3

(a) 0.25
(b) 0
(c) 3
(d) 0.75
(e) 0.5
(f) None of the above.

12. Find the median and mode for the given frequency distribution:

x	f
-3	2
0	4
1	3
2	3

(a) median: 1, mode: 0
(b) median: 0.5, mode: 0
(c) median: 0.25, mode: -3
(d) median: 0.25, mode: 0
(e) median: 0, mode: 0.5
(f) None of the above.

A.6 Be able to calculate range, variance, and standard deviation for a sample of n numbers, $n \leq 6$ (pg. 138). (3.2)

A.7 In section 3.2, we also learned about standard deviation for frequency tables and grouped distributions, but this information will NOT be tested on the exam. Also, this section discussed sample variance versus population variance; population variance will also NOT be tested. Chebychev's theorem was on the homework but will NOT be tested.(3.2)

13. Find the standard deviation of the sample: 15, 17, 18, 23, 18, 17

(a) $\frac{36}{5}$
(b) $\frac{6}{5}\sqrt{230}$
(c) $\frac{12}{5}\sqrt{65}$
(d) 0
(e) $\frac{6\sqrt{5}}{5}$
(f) None of the above.

14. Five female freshmen are asked to rate the quality of a fragrance from 1 to 4. They answer 2,1,2,4,1. What is the variance of this sample?

(a) $\frac{\sqrt{6}}{2}$
(b) 0
(c) $\frac{3}{2}$
(d) -1
(e) $\frac{1}{2}$
(f) None of the above.

A.8 Know the characteristics of the standard normal curve (p.148). Understand the relationship between area under the curve and probabilities. Be able to use a table to solve questions involving normal distributions, including using z-scores (p.151) to find probabilities, or probabilities to find z-scores. (3.3)

15. (B) Which of the following is NOT a characteristic of a normal probability distribution?

(a) The area under the curve is always 1.
(b) $P(X \leq -z) = 1 - P(X \leq z)$.
(c) The area to the right of b is the probability than an observed data value will be less than b.
(d) The peak occurs directly above the mean μ.
(e) The curve is symmetric about the mean μ.
(f) None of the above.

16. (B) Find the percent of total area under the standard normal curve between the z-scores $z = 0.1$ and $z = 2.01$.

(a) 43.80%
(b) 97.78 %
(c) 53.98%
(d) 56.20%
(e) 2.00%
(f) None of the above.

17. Find the percent of the area under a normal curve that is more that 0.8 standard deviations away from the mean (both above and below).

(a) 21.19%
(b) 78.81 %
(c) 42.38 %
(d) 39.41 %
(e) 63.57%
(f) None of the above.

18. For a certain midterm, the distribution of grades was normal with mean 75 and standard deviation 10. On the midterm, Julie did better than 75% of the students in her class. What was Julie's grade on the exam? (Round to a whole number.)

(a) 100
(b) 95
(c) 85
(d) 77
(e) 82
(f) None of the above.

19. To be graded extra large, an egg must weigh at least 2.2 oz. If the average weight for an egg is 1.5 oz, with a standard deviation of 0.4 oz, how many eggs in a sample of five dozen would you expect to grade extra large? (Round to a whole number)

(a) 0
(b) 1
(c) 2
(d) 4
(e) 8
(f) None of the above.

A.9 Given the equation of the line, be able to graph the line and find the slope and x- and y-intercepts. Given information about a line (two points, point and slope, intercepts) be able to find the equation of a line. Know how the slopes of parallel and perpendicular lines are related. (4.1) Note: The information of this section may not be tested directly.

A.10 From a word problem, be able to find the line or linear function that models the situation. Be comfortable with the notations of functions and the terminology associated with supply and demand (p.186-187) and cost analysis (p.188-189)

20. (B) Find the equation of the line perpendicular to $2x + 3y = 4$ which has y-intercept $(0, -3)$.

(a) $2x + 3y = -9$
(b) $2x - 3x = 9$
(c) $x - 3y = 9$
(d) $3x - 2y = 6$
(e) $3x - y = 3$
(f) None of the above.

21. A line through the points $(4, 8)$ and $(9, -2)$ also goes through $(-1, a)$. What is a?

(a) 5.5
(b) 6.5
(c) 14
(d) 18
(e) 19
(f) None of the above.

22. Suppose that the supply function for walnuts is $S(q) = 0.25q + 3.6$ where S is the price in dollars per pound and q is the quantity in bushels. Suppose also that the demand function is $D(q) = 9 - 0.35q$. Find the equilibrium price.

(a) \$0.36
(b) \$5.85
(c) \$9.00
(d) \$9.36
(e) \$25.71
(f) None of the above.

23. If it costs \$300 to produce 60 T-shirts and \$400 to produce 100 T-shirts, find the fixed costs for producing these T-shirts.

(a) \$50.00
(b) \$100.00
(c) \$150.00
(d) \$200.00
(e) \$250.00
(f) None of the above.

A.11 Be able to find the least squares line $y = mx + b$ that gives the best fit to the data points $(x_1, y_1), (y, y_2), \ldots, (x_n, y_n)$ $(n \leq 5)$. Memorize the formulas (p.195) (4.3)

A.12 Be able to calculate the correlation coefficient for data consisting of 5 or fewer points. Memorize the formula. Know how to interpret the correlation coefficient. Be able to look at a scatter plot and determine whether the correlation coefficient is positive, negative, of close to zero. (4.3)

24. Which are the correct equations to calculate the best fit line $y = mx + b$?

    (a) $m = \dfrac{n(\Sigma x^2) - (\Sigma x)^2}{n(\Sigma xy) - (\Sigma x)(\Sigma y)}$; $b = \dfrac{\Sigma y - n(\Sigma x)}{m}$

    (b) $m = \dfrac{n(\Sigma x^2) - (\Sigma x)^2}{n(\Sigma y^2) - (\Sigma x^2)}$; $b = \dfrac{\Sigma x - m(\Sigma y)}{n}$

    (c) $m = \dfrac{n(\Sigma y^2) - (\Sigma y)^2}{n(\Sigma xy) - (\Sigma x)(\Sigma y)}$; $b = \dfrac{\Sigma x - m(\Sigma y)}{n}$

    (d) $m = \dfrac{n(\Sigma y^2) - (\Sigma y)^2}{n(\Sigma x^2) - (\Sigma x)^2}$; $b = \dfrac{\Sigma y - n(\Sigma x)}{m}$

    (e) $m = \dfrac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2}$; $b = \dfrac{\Sigma y - m(\Sigma x)}{n}$

    (f) None of the above.

Use the data (0,4), (1,2), (2,1), (3,0) to answer the following three questions:

25. Find the best fit line for the data.

    (a) $y = -\frac{10}{13}x + 4$
    (b) $y = -\frac{4}{3}x + 4$
    (c) $y = -\frac{10}{13}x + \frac{151}{40}$
    (d) $y = -\frac{13}{16}x + \frac{49}{40}$
    (e) $y = -\frac{13}{10}x + \frac{37}{10}$
    (f) None of the above.

26. Find the correlation coefficient r for the data.

    (a) $r = \frac{\sqrt{13}}{35}$
    (b) $r = \frac{35}{13}$
    (c) $r = \frac{1}{\sqrt{39}}$
    (d) $r = -\frac{\sqrt{7}}{35}$
    (e) $r = -\frac{13}{5\sqrt{7}}$
    (f) None of the above.

27. Which of the following statements is most correct about this data?

    (a) It is appropriate to use a line to approximate this data because r is close to -1.
    (b) It is appropriate to use a line to approximate this data because r is close to 0.
    (c) It is appropriate to use a line to approximate this data because r is close to 1.
    (d) It is NOT appropriate to use a line to approximate this data because r is close to 0.
    (e) It is NOT appropriate to use a line to approximate this data because r is close to -1.
    (f) None of the above.

A.13 Be able to solve a linear system in two or more variables. Be able to tell when a system has no solution (inconsistent), a unique solution, or has infinitely many solutions. Be comfortable with parameters and be able to write infinite solutions in terms of parameters. (5.1, 5.2)

A.14 Be able to write a linear system as an augmented matrix. Be able to use row operations and the Gauss Jordan method to solve the system. (5.2)

A.15 Be able to set up a linear system from a word problem (5.1, 5.2).

28. Bob and Carol make two sizes of kites out of paper and wood strips. Each small kite uses 4 square feet of paper and 2 feet of wood strips, and each large kite uses 8 square feet of paper and 3 feet of wood strips. There are 160 square feet of paper and 70 feet of wood strips available. If all of the paper and all of the wood strips are used to make large and small kites, how many large kites will be made?

(a) 10
(b) 20
(c) 50
(d) 100
(e) 200
(f) None of the above.

29. A system of equations in the variables x, y, z and w has an augmented matrix in reduced form

$$\begin{bmatrix} 1 & 1 & 0 & 5 & -3 \\ 0 & 0 & 1 & -5 & 1 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

The solution of the system is:

(a) $x = -3 - y - 5w$, $z = -1 + 5w$, y and w arbitrary parameters.
(b) $x = 3 - y + 5w$, $z = -1 + 5w$, y and w arbitrary parameters.
(c) $x = -3 - y - 5w$, $z = 1 + 5w$, y and w arbitrary parameters.
(d) $x = 3 - z - 5w$, $y = 1 + 5w$, z and w arbitrary parameters.
(e) $x = 3 + y - 5w$, $z = 1 + 5w$, y and w arbitrary parameters.
(f) None of the above.

30. (B) Which augmented matrix below corresponds to the system of equations $\left\{ \begin{array}{rcl} y = x & - & 3 \\ y = 1 & + & z \\ z = 4 & - & x \end{array} \right\}$.

(a) $\begin{bmatrix} 1 & -1 & 0 & -3 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & -4 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & 1 & 0 & -3 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & -4 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & -1 & 0 & 3 \\ 0 & 1 & -1 & 1 \\ 1 & 0 & 1 & 4 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & 1 & 0 & 3 \\ 0 & 1 & -1 & 1 \\ 1 & 0 & 1 & 4 \end{bmatrix}$

(e) $\begin{bmatrix} 1 & -1 & 0 & 3 \\ 0 & 1 & 1 & -1 \\ 1 & 0 & -1 & -4 \end{bmatrix}$

(f) None of the above.

31. Solve the system of equations $\left\{\begin{array}{rcr} y = x & - & 3 \\ y = 1 & + & z \\ z = 4 & - & x \end{array}\right\}$ for y.

(a) -2
(b) -1
(c) 0
(d) 1
(e) 3
(f) None of the above.

32. Solve the system of equations $\left\{\begin{array}{rcrcr} & & y & + & z = 9 \\ -2x & - & 3y & + & 5z = 33 \end{array}\right\}$

(a) $(4z - 30, 9 - z, z)$
(b) $(3 - z, 9 - z, z)$
(c) $(4z - 30, -z - 9, z)$
(d) $(z - 3, -z - 9, z)$
(e) $(z - 3, 9 + z, z)$
(f) None of the above.

Extension problems: On each exam, roughly 20% of the points will come from what I call extension problems. These are problems that you most likely have not seen before, and which generally require a combination of techniques or a little ingenuity to solve.

33. If a two coins are chosen at random from a box containing four pennies, two dimes, and one quarter, what is the expected (monetary) value?

(a) 7 cents
(b) 9.33 cents
(c) 12 cents
(d) 13 cents
(e) 14 cents
(f) None of the above

34. In the following k is some number:

$$\begin{aligned} 2x + 1y + 2z + 2w - 4v &= k \\ 2x + 2y + 2z + 3w - 4v &= -3 \\ 2x + 1y + 2z + 3w - 4v &= 0 \end{aligned}$$

Solve the system for y

(a) $k + 3$
(b) $-k - 3$
(c) $-k + 3$
(d) -3
(e) 0
(f) None of the above.

Standard Normal Cumulative Distribution Function

Area under the standard normal curve to the left of z.

z	0	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	0.9925	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	0.9959	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
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

01=e, 02=a, 03=e, 04=d, 05=a, 06=c, 07=b, 08=c, 09=c, 10=e, 11=a, 12=b,
13=e, 14=c, 15=c, 16=a, 17=c, 18=e, 19=c, 20=d, 21=d, 22=b, 23=c, 24=e,
25=e, 26=e, 27=a, 28=a, 29=c, 30=c, 31=d, 32=a, 33=e, 34=d