MATH M118: Finite Mathematics
Sample Department Final Examination
(The actual final examination will be identical to this sample in length, format, and difficulty.)

Directions:

- Place your name and student identification number in the blanks provided.
- Check the section number that you are enrolled.
- You have 2 hours to complete this examination.
- The examination is closed book and notes. You may use a calculator.
- Perform all work in this test booklet.
- Should you need scrap paper, the proctor will provide it upon request.
- There are 20 questions worth 5 points each.
- Partial credit will be awarded based on the work in this test booklet.
- Table B is provided on the last page. You may remove it from the test booklet.

Name: _____   Student ID: _____

Check your section/instructor of the course:

_____ Section C632 MW 11:00 BS3006 Davis	_____ Section C638 TR 1:00 BS3006 Tam
_____ Section C633 MW 2:30 BS2000 Patterson	_____ Section C639 TR 2:30 BS3006 Tam
_____ Section C634 MW 4:00 BS3006 Omran	_____ Section C640 TR 5:45 LE103 Barkat
_____ Section C635 MW 5:45 LE105 Schilling	_____ Section C642 MW 6:00 CS136 Davis
_____ Section C636 MW 7:15 LE103 Omran	_____ Section C651 TR 9:30 LE101 Watt
_____ Section C637 TR 9:30 LE101 Watt	_____ Section R827 TR 2:30 BS3006 Tam

---------------------------- DO NOT WRITE BELOW THIS LINE ----------------------------

Total page 1: _____ / 20 points

Total page 2: _____ / 20 points

Total page 3: _____ / 20 points

Total page 4: _____ / 20 points

Total page 5: _____ / 20 points

TOTAL SCORE: _____ / 100 points   Grade: _____

1. Complete the entries in the truth table.

p	q	r	$p \; q$	$p \; r$	$(p \; q) \; (p \; r)$
T	T	T			
T	T	F			
T	F	T			
T	F	F			
F	T	T			
F	T	F			
F	F	T			
F	F	F			

2. Construct a Truth Table and determine whether the following argument is valid.

If it rains, then the crops will grow. It did not rain. Therefore, the crops did not grow.

3. Determine if the following statements are true of false (1 pt each). Circle true or false.
   A, B, C, D, E, F, G, and H are subsets of U.

   $D \quad D' = U$ *True*   or   *False*

   $B \quad C \quad B \quad C$ *True*   or   *False*

   $U - A = A'$ *True*   or   *False*

   $E - F = E \quad F'$ *True*   or   *False*

   $(G \quad H) = G' \quad H'$ *True*   or   *False*

4. Blood can be typed as A, B, AB, or O depending on whether the A antigen, B antigen, both A and B antigens, or neither A or B antigens are present in the blood respectively. Of the 200 patients in a hospital, there are 105 with antigen A present and 75 with antigen B present.
   Draw a Venn diagram for this problem.
   If 42 patients have type AB blood, how many patients have type O?

5. Let *A, B,* and *C* be subsets of *U*, find all the elements of *A, B,* and *C*.
   U = { 1, 2, 3, 4, 5, 6, 7, 8, 9 },

   A = { 2, 4, 6, 8 }*B* ∪ *C* = { 2, 3, 5, 6, 7, 8, *B* }, *C* = {7}

   A ∩ *B* = { 1, 2, 3, 5, 7, 9*B*}, *C* = { 0, 1, 4 }*A* ∩ *C* = {7, 9}.

6. A license plate "number" consists of two digits followed by two letters of the alphabet, which is followed by four more digits (digits are selected from the set {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}) with repetitions allowed. Circle the correct set up to determine the number of possible license plate numbers.

   10 26 25 10 9 8 7   10 26 26 10 10 10 10

   10 10 26 25 10 9 8 7   10 10 26 26 10 10 10 10

   10 9 26 25 10 9 8 7   99 26 26 10,000

7. How many different committees of 3 can be formed from 15 Republicans and 12 Democrats if at least one Republican and at least one Democrat must be on the committee? Circle the correct set up.

   P(15,3) *P*(12,3)   *C*(15,3) *C*(12,3)

   P(15,1) *P*(12,2) − *P*(15,2) *P*(12,1)   *C*(15,1) *C*(12,2)+ *C*(15,2) *C*(12,1)

   1 − *P*(15,3) *P*(12,3)   1 − *C*(15,3) *C*(12,3)

8. A fair die is rolled eight times. What is the probability that the point "5" occurs at least 7 times?

9. An unfair die is rolled once. The probability of an even number is twice that of an odd number. Find Pr[1 or 2].

10. Events A and B are independent. $Pr[A] = \frac{1}{3}$ and $Pr[B] = \frac{1}{4}$. Find $Pr[(A \cap B)]$.

11. A bucket contains 4 red balls and 6 blue balls. Five balls are drawn simultaneously and at random. Circle the set up to determine the probability that at least 3 red balls are chosen.

$$Pr[E] = \frac{C(4,3)C(6,2)}{C(10,5)}$$

$$Pr[E] = 1 - \frac{C(4,0) + C(4,1) + C(4,2)}{C(10,5)}$$

$$Pr[E] = \frac{C(4,3)C(6,2) + C(4,4)C(6,1) + C(4,5)C(6,0)}{C(10,5)}$$

$$Pr[E] = \frac{C(4,3)C(6,2) + C(4,4)C(6,1)}{C(10,5)}$$

12. A pocket contains 3 nickels, 2 dimes, and 1 quarter. Two coins are selected simultaneously and at random. A random variable, X, is defined to be the total value in cents of the two coins. Find the expected value, E[X].

13. Find the standard deviation for the probability density function with $E[X] = -1.6$.

X	Pr[X]
0	.2
-2	.3
4	.2
-6	.3

14. A bag of 1,000 fair coins is dumped onto a table. What is the probability that at most 485 coins land heads?

15. Given $A = \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 0 \\ 0 & -3 \end{bmatrix}$, find $2A - B$.

16. One of the matrix products AB or BA is defined. Find the product (compute the matrix).

$$A = \begin{bmatrix} 4 & 0 & 5 \\ 1 & -2 & 0 \end{bmatrix}, \quad B = \begin{bmatrix} -2 & 0 & 1 \\ 0 & 3 & 2 \\ -1 & 4 & 0 \end{bmatrix}$$

17. A survey of weather conditions at a certain vacation resort indicated that if the weather on a particular day was:
Sunny (state 1), the probability was 0.6 that the next day would be sunny, 0.2 that the next day would be overcast, 0.2 that the next day would be rainy;
Overcast (state 2), the probability was 0.6 that the next day would be sunny, 0 that the next day would be overcast, 0.4 that the next day would be rainy;
Rainy (state 3), the probability was 0.4 that the next day would be sunny, 0.1 that the next day would be overcast, 0.5 that the next day would be rainy.

Draw a transition diagram AND a transition matrix for the Markov chain.

18. Determine which statement about the Markov chain represented by the transition matrix below is true.

$$T = \begin{matrix} .5 & 0 & .5 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & .3 & 0 & 7 \\ 0 & 0 & 0 & 1 \end{matrix}$$

State 1 communicates with states 1 and 3, and the matrix is irreducible.

State 1 communicates with states 2 and 4, and the matrix is irreducible.

State 4 does not communicate with states 1, 2, and 3, and the matrix is irreducible.

State 4 communicates with states 1, 2, and 3, and the matrix is not irreducible.

State 4 does not communicate with states 1, 2, and 3, and the matrix is not irreducible.

19. A Markov chain has the transition matrix $\begin{bmatrix} .3 & .7 \\ .4 & .6 \end{bmatrix}$. If the chain begins in state 2, what is the probability that it will be in state 1 after two transitions?

20. Given $P_0 = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$ and $T = \begin{bmatrix} 0 & 1 & 0 \\ 0 & .5 & .5 \\ 1 & 0 & 0 \end{bmatrix}$ find P_3 and the steady state vector.
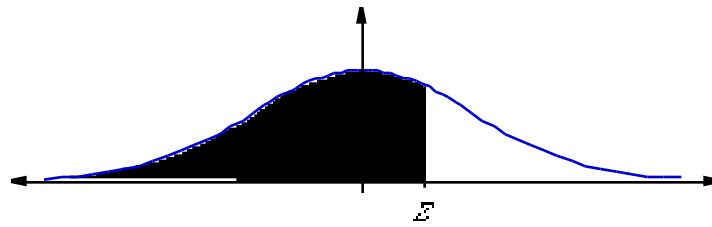
The table entry is the probability of being at or below the Z score.

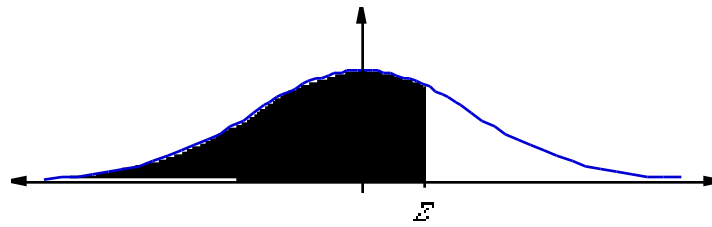| Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-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	.0721	.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

The table entry is the probability of being at or below the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9992	.9993