Final Examination
2.5 Hours

Mathematics 110   **Fall 2024**
Instructions: Answer all questions. Show all work in the exam booklet.

1.   The members of a science club are voting on which color to use on their club banner with their
        preference rankings listed below. Please note that "√" indicates approval.

Number of Votes

Color	5	7	10	12	4	9	5	11
Black	1√	1√	1√	2√	2	2	3	3
Blue	2√	2	3	1√	1√	3	1√	2
Gold	3	3	2√	3	3	1√	2√	1√

A)   Which color wins using plurality voting?
B)   Which color wins using plurality with a runoff?
C)   Which color wins using Borda's method?
D)   Which color wins using approval voting?
E)   Which color, if any, would be the Condorcet winner?

2.   A)   If 1723 votes are cast in an election that is to be decided by plurality, what is the smallest
                number of votes a candidate can win with in a five-candidate race if no ties are allowed?

        B)   There are 240 votes to be cast in a plurality election among five candidates- Harold, Julia,
                Kyle, Lois, and Michael. After the first 210 votes are counted, the tallies are as follows:
                        Harold - 57
                        Julia - 26
                        Kyle - 45
                        Lois - 62
                        Michael - 20
        What is the minimal number of remaining votes Kyle needs to be assured of a win?

3.   A certain college would like to distribute 12 new SMART Boards to various departments based on
        the anticipated number of sections available in the upcoming semester.

Department	Biology	Chemistry	Mathematics	Physics
No. of Sections	59	65	74	42

        Apportion the 12 SMART Boards based on the number of sections using
        A)   Hamilton's method.
        B)   Lowndes' method.
        C)   Jefferson's method.

4.   A random sample of customer ages for a salon are listed below:
                9   12   14   21   18   17   14   15
                23   15   10   16   14   13   14

A)   Construct a frequency table and frequency polygon using the age intervals 5-9, 10-14, 15-19,
        and 20-24.
B)   Determine the mode, range, mean, and standard deviation for the sample.
C)   Find the five-number summary, then construct a box-and-whisker plot.

5.   Assume that a license plate must begin with three capital letters (A-Z), followed by three digits (0-9). How many different license plates are possible
    A)   if repetition of letters and digits is allowed?
    B)   if neither repetition of letters nor repetition of digits is allowed?
    C)   if the plate must begin with a "B", and repetition of letters and digits isn't allowed?
    D)   if repetition of letters and digits is allowed, but the plate must end with a "9"?

6.   An experiment has outcomes 0, 1, 2, 4, and 8 with the probabilities as shown below.

p(x)	.35	?	.1	.2	.1
x	0	1	2	4	8

    A)   Find the missing p(x).
    B)   Determine the mean. (Round to the nearest whole number.)
    C)   Determine the standard deviation. (Round to one decimal place.)
    D)   Calculate the probability of having an outcome less than 4.
    E)   Construct the probability histogram.

7.   A bag contains 10 black marbles (labelled with the numbers 1 through 10), 10 purple marbles (labelled 1-10), 5 white marbles (labelled 1-5), and 3 orange marbles (labelled 1-3). Find the probability that
    A)   a purple marble is selected from the bag.
    B)   a purple marble **OR** a #5 marble is selected from the bag.
    C)   a black marble is selected, replaced, and then a white marble is selected from the bag.
    D)   a black marble is selected, and then, without replacement, a white marble is selected.

8.   A company gave their employees a survey to determine the average number of hours they work on a weekly basis. Assume the distribution is approximately normal with $\mu = 55$ hrs and $\sigma = 10$ hrs.
    A)   Find the percentage of employees who work less than 55 hours.
    B)   Find the percentage of employees who work more than 76 hours.
    C)   Find the percentage of employees who work between 42 and 49 hours.
    D)   If there are 20,000 employees at the company, how many work less than 61 hours?
    E)   Above what number of hours do 60.64% of employees work?

Statistical Tables

Table A   Normal Curve (z) Table

The normal curve table gives only the percentage of data starting from the middle $(z = 0)$, out to whatever z score you look up. For instance, if you look up $z = 1.28$, you get .3997. This means .3997 or 39.97% of the data in the normal curve is found between $z = 0$ and $z = 1.28$.
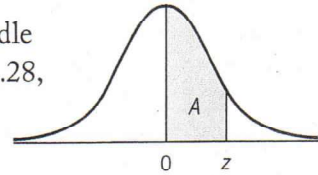
					Normal					
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998