QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS
FINAL EXAMINATION
2.5 HOURS

Mathematics 110 **Fall 2025**

Instructions: Answer all questions. Show all work in the exam booklet. Box final answers.

1) The members of a club are voting on how many hours of community service should be required of its members each year. Their preference rankings are listed below. Please note that "√" indicates approval.

Number of Votes

Service	1	8	6	2	9	5	3
5 Hours	1√	1√	2√	2√	2√	3	4
10 Hours	2	3√	1√	3	4	1√	3√
15 Hours	3	2√	4	1√	3√	2√	2√
20 Hours	4	4	3	4	1√	4	1√

A) [3 pts] Which option wins using plurality voting?
B) [2 pts] Which option wins plurality with a runoff between the top two finishers?
C) [3 pts] Which option wins using Borda's method?
D) [3 pts] Which option wins using approval voting?
E) [3 pts] Which option, if any, would be the Condorcet winner?

2) **A)** [2 pts] If 3,500 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 an eight-candidate race if no ties are allowed?

B) [3 pts] There are 165 votes to be cast in a plurality election among four candidates- Ryan, Stefania, Ursula, and Victor. After the first 105 votes are counted, the tallies are as follows:

Ryan - 32
Stefania - 12
Ursula - 45
Victor - 16

What is the minimal number of remaining votes Ryan needs to be assured of a win?

3) There are 60 house seats for representatives for the student government. The seats will be apportioned to five housing units on a college campus based on the number of residents, as listed in the table.

Housing Unit	Alwyn	Blackwell	Quad	Roosevelt	Yellowstone
No. of Residents	241	320	163	170	246

A) [4 pts] Apportion the house seats using Hamilton's method.
B) [4 pts] Apportion the house seats using Lowndes' method.
C) [4 pts] Apportion the house seats using Webster's method.
D) [1 pt] How many seats would a housing unit with a natural quota of 6.4832 be initially allocated using Hill-Huntington's method?

4) [6 pts] Determine the mean (rounded to the nearest whole number) and the standard deviation given the following sample: **43 25 45 38 52 37 62.**

(continued on the back)

5) A random sample of n=22 grades on an English test are listed below:

42	**94**	**63**	**72**	**80**	**53**	**93**	**65**	**78**	**62**	**71**
54	**67**	**98**	**60**	**75**	**75**	**98**	**98**	**99**	**88**	**49**

A) [2 pts] Determine the median, mode, and range for this data.
B) [1 pt] What proportion of the grades are above a 70?
C) [5 pts] Construct a frequency table and frequency polygon using 40-49 as the first grade interval.
D) [4 pts] Determine the five-number summary, then construct and label a box-and-whisker plot.

6) Ellie owns two scarves, five pairs of jeans, three skirts, nine shirts, and four pairs of shoes.
A) [4 pts] If an outfit consists of shoes, a shirt, and either a pair of jeans or a skirt, with a scarf being optional, in how many ways can Ellie construct an outfit?
B) [4 pts] How many outfits are available if a scarf isn't optional?
C) [4 pts] How many outfits are available if a scarf isn't optional and she must wear a skirt?

7) On a special die, the faces are marked 1-2-3-A-5-B.
A) [3 pts] If the die is rolled once, what's the probability it lands on a letter?
B) [4 pts] If the die is rolled twice, what's the probability both rolls are an odd number?
C) [4 pts] If the die is rolled three times, what's the probability all rolls are the same?

8) An experiment has outcomes 0, 1, 5, 8, and 9 with the probabilities as shown below.

p(x)	.18	.21	.25	?	.16
x	0	1	5	8	9

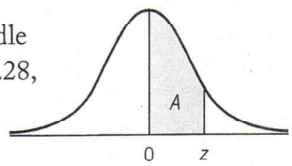
A) [1 pt] Find the missing p(x).
B) [2 pts] Determine the mean. (Round to the nearest whole number).
C) [4 pts] Determine the standard deviation. (Round to one decimal place.)
D) [1 pt] Calculate the probability of having an outcome less than 8.
E) [3 pts] Construct the probability histogram.

9) Scores on a physics exam have an approximately normal distribution with $\boldsymbol{\mu = 68}$ and $\boldsymbol{\sigma = 14}$.
A) [4 pts] Find the percentage of scores above 81.
B) [4 pts] Find the percentage of scores below 70.
C) [4 pts] If 500 students took the exam, about how many students scored between 45 and 65?
D) [4 pts] Below what grade can you find the lowest 16% of all grades?

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