

QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS
FINAL EXAMINATION
2.5 HOURS

Mathematics 110Spring 2026

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

- 1) The preference rankings of 47 students are listed below. Please note that “√” indicates approval.

Number of Votes							
Sport	5	9	8	11	4	7	3
Hockey	1√	1√	2√	2	3	3	4
Baseball	2√	4	1√	3	1√	1√	1√
Soccer	3√	2√	3√	1√	2√	4	2√
Basketball	4	3	4	4	4	2√	3

- A) [3 pts] Which sport wins using plurality voting?
B) [2 pts] Which sport wins plurality with a runoff between the top two finishers?
C) [3 pts] Which sport wins using Borda’s method?
D) [3 pts] Which sport wins using approval voting?
E) [3 pts] Which sport, if any, would be the Condorcet winner?
- 2) A) [2 pts] If 2,200 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 six-candidate race if no ties are allowed?
B) [3 pts] There are 190 votes to be cast in a plurality election among four candidates- Wayne, Xander, Yasmin, and Angela. After the first 150 votes are counted, the tallies are as follows:

Wayne - 48
Xander - 34
Yasmin - 55
Angela - 13

- What is the minimal number of remaining votes Wayne needs to be assured of a win?
- 3) There are 20 camp counselors at a camp held for kids in grades 2 through 5. The camp would like to apportion the counselors to the different grades based on the number of kids, as listed in the table.

Grade	2	3	4	5
No. of Kids	78	63	92	101

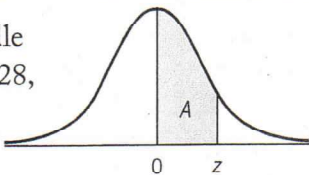
- A) [4 pts] Apportion the counselors using Hamilton’s method.
B) [4 pts] Apportion the counselors using Lowndes’ method.
C) [4 pts] Apportion the counselors using Jefferson’s method.
D) [1 pt] How many counselors would be initially allocated to a grade with a natural quota of 7.4752 using Hill-Huntington’s method?
- 4) [6 pts] Determine the mean (rounded to the nearest whole number) and the standard deviation given the following sample: 36 20 38 33 45 32 55.

- 5) A random sample of $n=20$ customer ages for a pizzeria, is listed below.
- | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|
| 12 | 17 | 35 | 10 | 57 | 28 | 74 | 35 | 60 | 45 |
| 42 | 62 | 44 | 25 | 48 | 72 | 32 | 73 | 51 | 35 |
- A) [2 pts] Determine the median, mode, and range for this data.
 B) [1 pt] What proportion of the ages are below 30?
 C) [5 pts] Construct a frequency table and frequency polygon using 10-19 as the first age interval.
 D) [4 pts] Determine the five-number summary, then construct and label a box-and-whisker plot.
- 6) Assume that a password must begin with four capital letters (A-Z), followed by three digits (0-9). How many different passwords are possible if:
 A) [4 pts] repetition of letters and digits is allowed?
 B) [4 pts] repetition of letters and digits isn't allowed?
 C) [4 pts] the password must begin with an "N", and repetition of letters and digits isn't allowed?
- 7) A bag contains 8 blue marbles (labelled with the numbers 1 through 8), 7 green marbles (labelled 1-7), and 10 black marbles (labelled 1-10). Find the probability that if:
 A) [3 pts] one marble is randomly selected, it is blue, **OR** marked with a #4.
 B) [4 pts] three marbles are randomly selected with replacement between selections, the first two are green, and the third is black.
 C) [4 pts] three marbles are randomly selected without replacement between selections, the first two are green, and the third is black.
- 8) An experiment has outcomes 1, 2, 3, 4, and 5 with the probabilities as shown below.
- | | | | | | |
|-------------|---|-----|----|-----|----|
| p(x) | ? | .12 | .3 | .17 | .2 |
| x | 1 | 2 | 3 | 4 | 5 |
- 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 greater than 2.
 E) [3 pts] Construct the probability histogram.
- 9) The salaries of employees at a company have an approximately normal distribution with $\mu = \$95,000$ and $\sigma = \$40,000$.
 A) [4 pts] Find the percentage of employees with salaries less than \$100,000.
 B) [4 pts] Find the percentage of employees with a salary between \$50,000 and \$85,000.
 C) [4 pts] If there are 2,000 employees at the company, how many have a salary above \$150,000?
 D) [4 pts] Below what amount are 79.10% of salaries at the company?

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