

Released Items

Student Name: _____

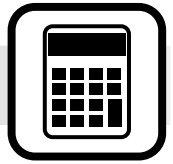
Fall 2015
NC Final Exam
Discrete Mathematics



Student Booklet



Public Schools of North Carolina
State Board of Education
Department of Public Instruction
Raleigh, North Carolina 27699-6314

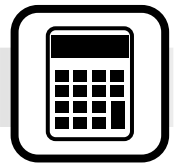


- 1 The matrix below shows the number of crews a construction company uses per building for three types of buildings.

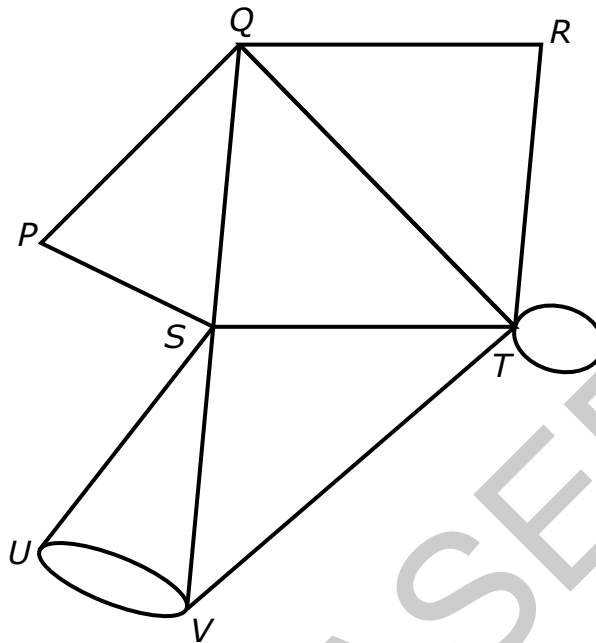
	Houses	Apartments	Offices
Building Crews	11	45	23
Electrical Crews	3	8	3
Plumbing Crews	4	6	2
Landscaping Crews	1	5	1

The company is currently working on 9 houses, 2 apartment buildings, and 6 office buildings. Which statement is true?

- A There are more building crews working on offices than on houses.
- B There are more electrical crews working on apartments than on offices.
- C There are more plumbing crews working on offices than on apartments.
- D There are more landscaping crews working on houses than on apartments.

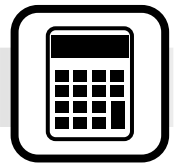


- 2 The graph below displays a relationship between 7 locations.

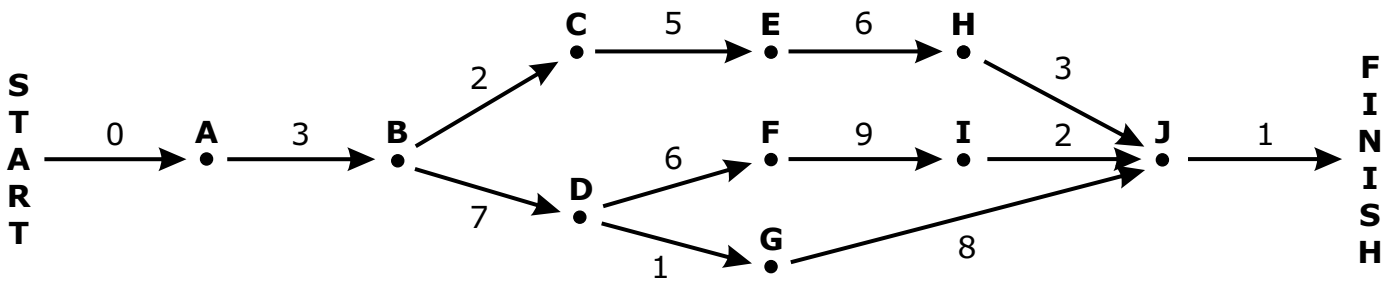


Can an Euler path be drawn for this graph?

- A no, because there are exactly 2 vertices with an odd degree
- B no, because each vertex is of an even degree
- C yes, because there are exactly 2 vertices with an odd degree
- D yes, because each vertex is of an even degree

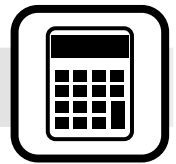


3 What is the critical path for the diagram below?



- A START-A-B-C-E-H-J-FINISH
- B START-A-B-C-E-J-FINISH
- C START-A-B-D-F-I-J-FINISH
- D START-A-B-D-G-J-FINISH

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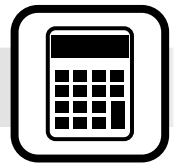


- 4 A student needs to complete the task list below for a project.

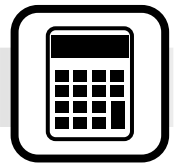
Task	Time	Prerequisites
Start	0 minutes	-
1	5 minutes	none
2	10 minutes	none
3	10 minutes	1
4	8 minutes	1, 3
5	4 minutes	2, 4
6	10 minutes	4
7	18 minutes	5, 6
8	7 minutes	7
Finish		

If multiple tasks can be done simultaneously, what is the minimum amount of time it will take the student to complete the task list?

- A 47 minutes
- B 52 minutes
- C 58 minutes
- D 72 minutes



- 5 Which group and purpose would work **best** in a census survey?
- A the students in one class, to determine what students in the school think about school lunches
 - B the workers in an entire office building, to determine the most preferred day for weekly meetings
 - C the citizens of one county, to determine who is preferred nationally in an upcoming presidential election
 - D the citizens of an entire city, to determine what citizens think about tourism in their state
- 6 The amount of time Mr. Smith spends exercising each day is approximately normally distributed with a mean of 30 minutes and a standard deviation of 10 minutes. On **approximately** what percent of the days in a year does Mr. Smith exercise for between 10 minutes and 40 minutes?
- A 50%
 - B 82%
 - C 88%
 - D 95%



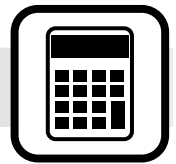
7 A stem-and-leaf plot is shown below.

Stem	Leaves
1	3, 7
2	2, 2, 3, 3, 3, 6, 7, 9
3	1, 2, 4, 8, 8
4	1
5	2

Which **best** describes the distribution of the data?

- A skewed right
- B skewed left
- C symmetric
- D bimodal

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- 8 A spinner is divided into 12 sections that are each equally likely to occur. The sections are lettered from A to L. Philip will spin the spinner 3 times. What is the probability that the spinner will land on the letter G exactly 1 out of the 3 times?

A $\frac{121}{5,184}$

B $\frac{121}{1,728}$

C $\frac{121}{576}$

D $\frac{121}{288}$

- 9 A school is selecting new members for a council.

- There are 10 seniors competing for 6 spots.
- There are 8 juniors competing for 5 spots.
- There are 9 sophomores competing for 4 spots.
- There are 7 freshmen competing for 2 spots.

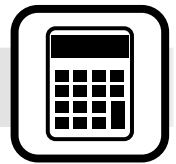
How many unique groupings of new members can the school make to fill the spots?

A 413

B 160,986

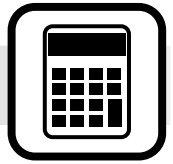
C 31,116,960

D 2,333,606,220



- 10 A ballot contains a list of 5 candidates. Each voter can choose 0 to 5 candidates. In how many ways can a voter complete the ballot?
- A 17
 - B 20
 - C 32
 - D 125
- 11 Suppose Caleb has an overall probability of $\frac{1}{10}$ of winning at a game of chance each time he plays. What is the **approximate** probability that Caleb will win the game at least once if he plays it 10 times?
- A 0.61
 - B 0.65
 - C 0.90
 - D 0.96

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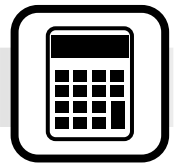


- 12 Thirteen members of the chess club have voted to determine who the new president will be. The table below shows the preference schedule for the four candidates.

	6 Votes	5 Votes	2 Votes
1st Place	Latesha	Maria	Kevin
2nd Place	Kevin	Kevin	Maria
3rd Place	Maria	Latesha	Latesha
4th Place	Jeff	Jeff	Jeff

The winner of the election will be determined using the plurality method. Kevin had decided to drop out of the election before the votes were counted. What effect, if any, will this have on the results of the election?

- A There will be no effect on the result of the election.
- B Maria was in the lead before Kevin dropped out, but Latesha will win once he has dropped out.
- C Latesha was in the lead before Kevin dropped out, but Maria will win once he has dropped out.
- D Kevin was in the lead before he dropped out, but Jeff will win once Kevin has dropped out.



- 13 A company has five board members. The board uses a weighted voting system to make decisions. At least 13 votes are needed to pass a motion. The weight of each board member's vote is listed below.

7, 5, 4, 2, 1

How many different winning coalitions are there?

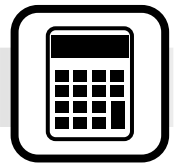
- A 6
B 8
C 9
D 11

- 14 A series is shown below.

$$\sum_{n=1}^{\infty} (2n - 1)$$

Which is true about the series?

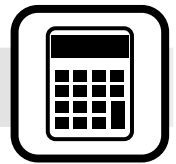
- A The series converges to -1 .
B The series converges to 1 .
C The series converges to 2 .
D The series diverges.



- 15 A game uses a spinner to determine if a player gains tokens or loses a token.
- The spinner is divided into 10 spaces labeled 1 through 10, each equally likely to occur.
 - If a player spins and lands on an odd number that is not 9, then the player gains 1 token.
 - If a player spins and lands on the number 9, then the player gains 2 tokens.
 - If a player spins and lands on an even number, then the player loses 1 token.

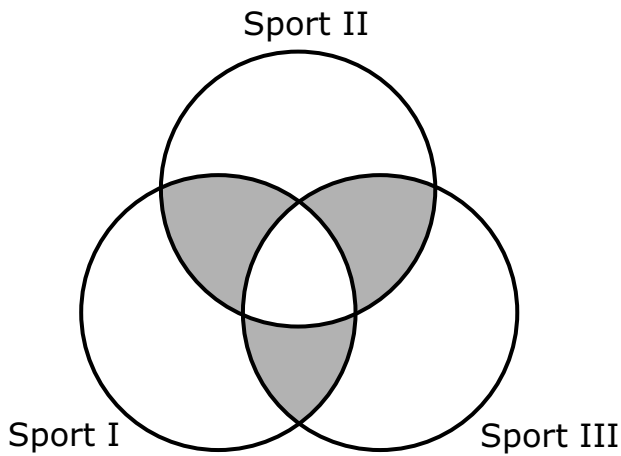
What is the expected number of tokens received for each turn?

- A 0.10
B 0.30
C 1.7
D 1.9
- 16 A team plays 8 games in September. For any game, there is a 0.60 probability that the team will win. What is the **approximate** probability of the team winning 4 to 6 of the games in September?
- A 0.762
B 0.720
C 0.254
D 0.240

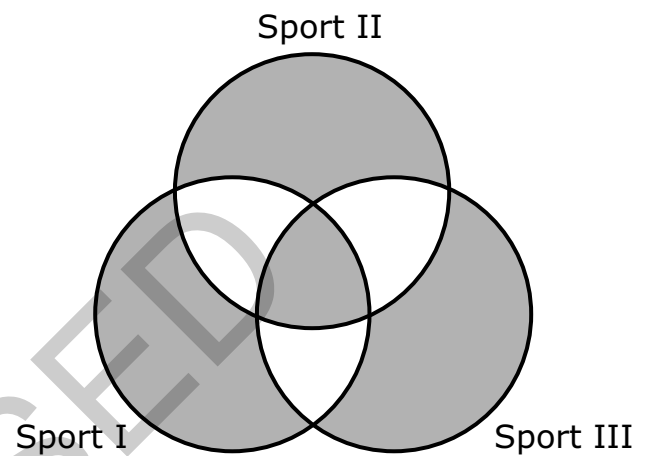


17 Students at a high school are offered three different sports to play, Sport I, Sport II, and Sport III. Which Venn diagram has shading in only the sections where students play exactly two of the sports?

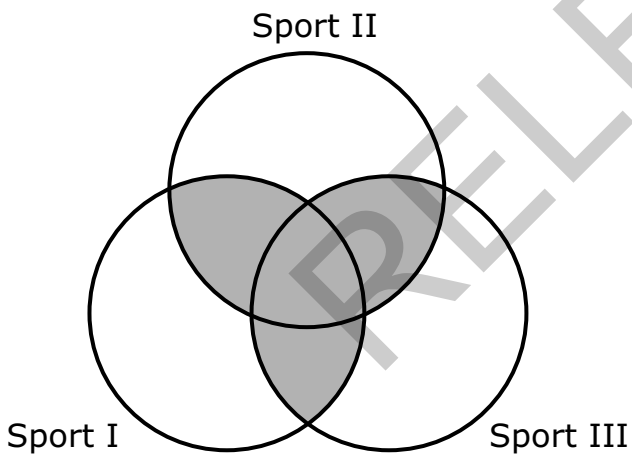
A



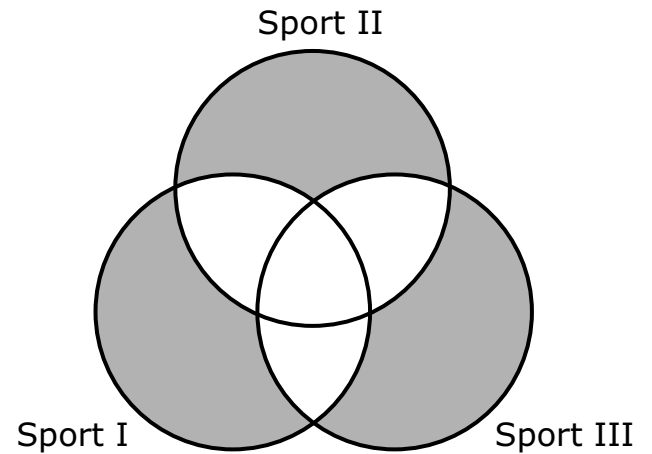
B

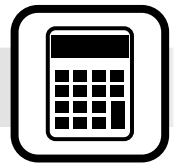


C

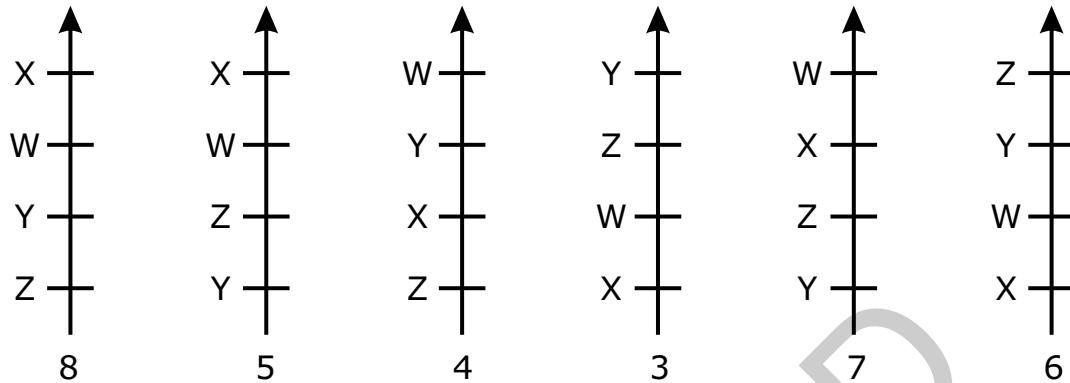


D





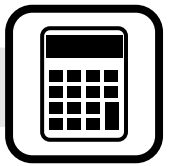
- 18 Four students, W, X, Y, and Z, ran for the position of classroom representative. The results of the voting are shown in the preference schedule below.



The winner was chosen using the sequential runoff method. Which student is the winner?

- A W
- B X
- C Y
- D Z

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This is the end of the Discrete Mathematics Released Items.

Directions:

- 1. Look back over your answers for the test questions.**
- 2. Make sure all your answers are entered on the answer sheet. Only what is entered on your answer sheet will be scored.**
- 3. Put all of your papers inside your test book and close the test book.**
- 4. Place your calculator on top of the test book.**
- 5. Stay quietly in your seat until your teacher tells you that testing is finished.**
- 6. Remember, teachers are not allowed to discuss items from the test with you, and you are not allowed to discuss with others any of the test questions or information contained within the test.**

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**Discrete Mathematics
RELEASED Items¹
Fall 2015
Answer Key**

Item Number	Type ²	Key	Percent Correct ³	Standard
1	MC	A	72%	1.01.a
2	MC	C	51%	1.02
3	MC	C	42%	1.02
4	MC	C	35%	1.02
5	MC	B	46%	2.01.a
6	MC	B	45%	2.01.d
7	MC	A	41%	2.01.e
8	MC	C	29%	2.02.f
9	MC	C	25%	2.02.b
10	MC	C	21%	2.02.b
11	MC	B	18%	2.02.f
12	MC	C	64%	2.03.b
13	MC	C	21%	2.03.c
14	MC	D	22%	3.01.c

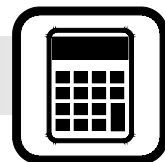


Item Number	Type ²	Key	Percent Correct ³	Standard
15	MC	A	30%	2.02.d
16	MC	B	40%	2.02.e
17	MC	A	84%	2.01.e
18	MC	A	50%	2.03.b

¹These released items were administered to students during a previous test administration. This sample set of released items may not reflect the breadth of the standards assessed and/or the range of item difficulty found on the NC Final Exam. Additional information about the NC Final Exam is available in the *Assessment Specification* for each exam located at <http://www.ncpublicschools.org/accountability/common-exams/specifications/>.

²This NC Final Exam contains only multiple-choice (MC) items.

³Percent correct is the percentage of students who answered the item correctly during a previous administration.



Standard Descriptions

This NC Final Exam is aligned to the 2003 Standard Course of Study. Only standard descriptions addressed by the released items in this booklet are listed below. A complete list of standards may be reviewed at <http://maccss.ncdpi.wikispaces.net/High+School>.

1.01.a

Use matrices to model and solve problems: Display and interpret data.

1.02

Use graph theory to model relationships and solve problems.

2.01.a

Describe data to solve problems: Apply and compare methods of data collection.

2.01.d

Describe data to solve problems: Recognize, define, and use the normal distribution curve.

2.01.e

Describe data to solve problems: Interpret graphical displays of data.

2.02.b

Use theoretical and experimental probability to model and solve problems: Calculate and apply permutations and combinations.

2.02.d

Use theoretical and experimental probability to model and solve problems: Find expected values and determine fairness.

2.02.e

Use theoretical and experimental probability to model and solve problems: Identify and use discrete random variables to solve problems.

2.02.f

Use theoretical and experimental probability to model and solve problems: Apply the Binomial Theorem.

2.03.b

Model and solve problems involving fair outcomes: Election Theory.

2.03.c

Model and solve problems involving fair outcomes: Voting Power.

**3.01.c**

Use recursion to model and solve problems: Determine whether a given series converges or diverges.

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