Advanced Mathematical Decision Making
Diagnostic Pre-Test
Fall Semester

1. Given that an average of 18 people can fit inside a square measuring 5 feet by 5 feet, estimate the size of a crowd that is 10 feet deep on both sides of the street standing along a 1-mile section of a parade route. (1 mile = 5,280 ft)

Use the following for questions #2 – 4

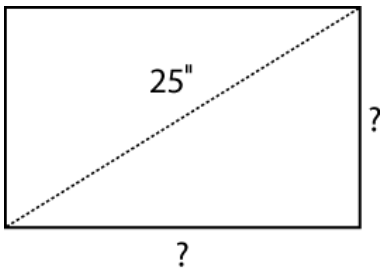
The psychology department at a local college is studying the effects of sleep deprivation on student test performance of the 1099 students at the college. Every 7th student enrolled at the college according to an ordered list of student ID numbers was chosen for the study. There were a total of 157 students participating in the study. All the students took an exam at 8am after a good night's sleep to get a baseline score for each student. The students then stayed up all night before an 8am exam (a variation of the same exam) one week later. Their grades on the exam were recorded and compared to the score they received after good night's sleep to see if there was any effect. The effect was recorded as the change in the number of points (+ or -) on the second exam. With 73% of the students, the score was at least 10 points lower.

2. The number 73% represents what type of information?
   A) population
   B) sample
   C) parameter
   D) statistic

3. What method of data collection was used in the study?
   A) experiment
   B) simulation
   C) census
   D) sampling

4. What type of sample was used in the study?
   A) random
   B) stratified
   C) cluster
   D) systematic

5. The size of a television is the length of the diagonal of its screen in inches. The aspect ratio of the screens of older televisions is 4:3, while the aspect ratio of newer wide-screen televisions is 16:9. Find the width and height of an older 25-inch television whose screen has an aspect ratio of 4:3.



Use the following information for questions #6 – 7

Consider two grading systems for determining your final class average. Each system is a weighted average of measures that include test grades, final exam grade, homework, and class participation.

Grading System I	Grading System II
Test average – 40%	Test average – 60
Final Exam Grade – 25%	Final Exam Grade – 15%
Homework – 25%	Homework – 15%
Class Participation – 10%	Class Participation – 10%

6. If your values are the following, which grading system do you prefer and why?
   - Test average = 84
   - Final exam grade = 68
   - Homework = 90
   - Class participation = 95

7. If you score 10 points higher on the final exam, how does your final grade average change under each system?

8. How many 3 letter arrangements of the word CHEMISTRY are possible?
   A) 84 B) 504 C) 720 D) not here

9. How many different 3 person committees can be formed from a group of 15 people?
   A) 2730 B) 45 C) 455 D) not here

Use the following data to answer questions #10 – 11

The Midtown Meteors keep track of the distance each member runs per week. The distances, in kilometers, are listed below*:*

48 62 54 38 46 40 53 63
34 45 36 63 51 60 52 44 33
47 55 42 39 57 49 56

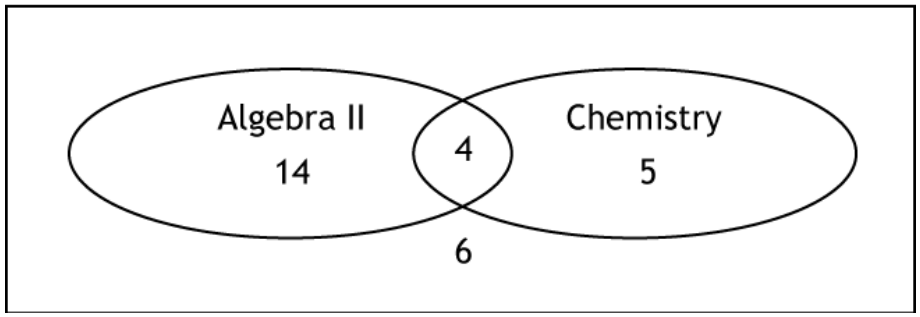
10. What is the interquartile range (IQR) for the data?
    A) 21.75 B) 41 C) 55.5 D) 14.5

11. Which of the following best describes shape of the distribution for the data?
    A) symmetric B) uniform C) skewed left D) skewed right

Use the following information to answer questions #12 – 13

Ms. Snow conducted a survey of her homeroom. She asked students what math course and what science course they were taking this semester. Below are the results.

Students in Ms. Snow's Homeroom

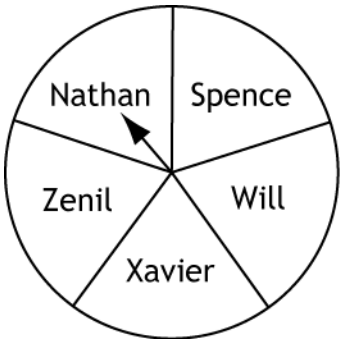


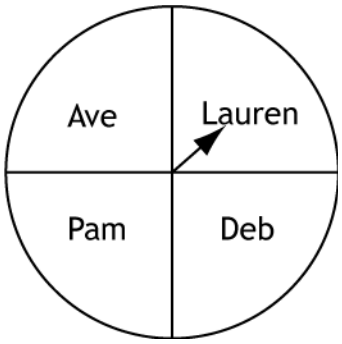
12. If a student is selected at random from Ms. Snow's homeroom, what is the probability that the student is taking Algebra II and Chemistry?

13. If a student is selected at random from Ms. Snow's homeroom, what is the probability that the student is not taking Algebra II or Chemistry?

Use the following to answer questions #14 – 15

As president of the high school band, Catrina needs to pick a committee of 2 to accompany her each time she visits middle schools. The director told her that each committee had to consist of 1 boy and 1 girl; 5 boys and 4 girls volunteered to go. To be fair, Catrina makes a spinner with the boys' names and a spinner with the girls' names. Each time she schedules a visit, Catrina spins each spinner once to determine who goes with her. If a spinner lands on a line, she spins again.





14. How many outcomes are in the sample space?

15. What is the probability that Nathan will be selected?

Given the following area model:

No Pumpkins	**No Pumpkins**
Pumpkins	
No Pumpkins	**No Pumpkins**

16. What is the probability of a person randomly selecting a pumpkin?

Use the following information to answer questions 17 & 18.

Victoria is playing a new video game in which the object is to find hidden treasures. To do so, she must travel through several levels, clashing with guards and watchdogs. In one part of the journey, Victoria must pass through two gates (Gate 1, then Gate 2) to get to the next level.

- **The chance that Gate 1 is open is 20%.**
- **The chance that Gate 2 is open is 30%.**
- **The game designer has programmed the gates so that the probability of both being open at the same time is 0.1.**

17. What is the probability that both gates are open when Victoria reaches this part of the game?

18. What is the probability that only Gate 1 is open when Victoria reaches this part of the game?

Use the following information to answer questions 19& 20

At the National Baseball Batting Contest, the organizers have set up game booths for the contestants. Marcus wants to win a large stuffed animal. The rules of the game are as follows:

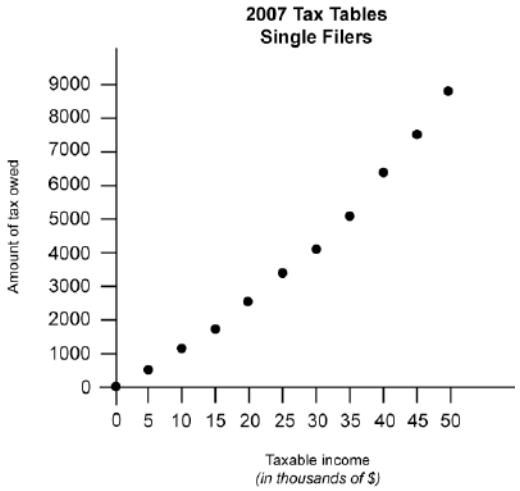
- **You are pitched 5 fastballs, and you must hit them into a fair zone to count.**
- **If you successfully hit all 5 pitches, you win a large stuffed animal.**
- **If you successfully hit 3 or 4 pitches, you win a small stuffed animal.**
- **If you successfully hit 1 or 2 pitches, you win a bat-shaped pencil.**

19. What is the probability of Marcus winning a large stuffed animal?

20. What is the probability of Marcus winning a small stuffed animal?

Advanced Mathematical Decision Making
Diagnostic Pre-Test
Spring Semester

1. Consider the following graph. Who are the subjects in the study? What are the variables of interest?



2. Decide if the data creates a linear function or not. If it is linear give the formula for it.

x	1	2	3	4
G(x)	4	10	16	22

x	1	2	3	4
P(x)	3	7	11	21

3. Coen decides to take a job with a company that sells magazine subscriptions. He is paid $20 to start selling and then earns $1.50 for each subscription he sells. How much money will Coen earn by the time he makes his 5th sale?

4. Suppose Coen's earning structure changed so that for every magazine subscription he sold, he made 1.5 times his previous earnings. Again, assume that he starts with $20 for 0 subscriptions sold. How much money will Coen earn by the time he makes his 4th sale?

Use the following information to answer questions 4 & 5:

During the 1990s and early 21st century, many states deregulated electricity. As a result, numerous electric companies can now provide electricity for a particular area. One such company is Lights and Power. To attract customers, Lights and Power is advertising a special:

Cheapest Electricity in Town!
To 1,000 kWh—$0.11 per kWh
More than 1,000 to 1,500 kWh—$0.18 per kWh
More than 1,500 kWh—$0.25 per kWh
No hidden fees! We promise!

5. According to the advertisement, how much does the first 1,000 kilowatt-hours (kWh) of electricity cost a customer?

6. Suppose Mrs. Brown uses 1,200 kilowatt-hours of electricity. How much does she pay altogether for 1,200 kilowatt-hours of electricity?

Kafi is considering three job offers in educational publishing.

- **One is a full-time position as an editor that pays a salary of $37,500 per year.**
- **Another is a full-time position as an e-Learning designer that pays an hourly wage of $26.50. The job assumes five 8-hour days per week.**
- **The final offer is for a sales representative that pays a 5% commission. Sales representatives typically sell an average of $100,000 per month in textbooks.**

7. Estimate the gross *annual* income and the gross *monthly* income for each job offer. For the purposes of his comparison, Kafi assumes that each job pays monthly.

Jobs	**Editor**	**Designer**	**Sales Representative**
Process			
Gross annual income			
process			
Gross monthly income			

8. Traci purchases a car for $16,000. If its value depreciates by 12% per year, what will be the car's value in 5 years?

Match each of the sequences with the correct closed form or recursive form formula shown.

9. 3, 12, 27, 48, … _____ a) $t_n = 3n - 2$ for $n = 1, 2, 3,\ldots$

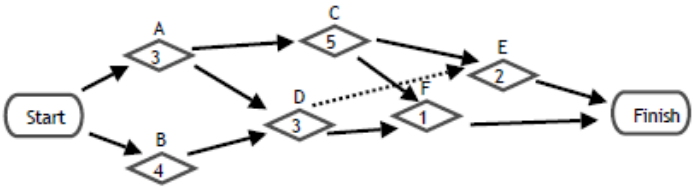
10. 3, −9, 27, −81, … _____ b) $t_1 =$ _____, $t_{n+1} = t_n + 5$

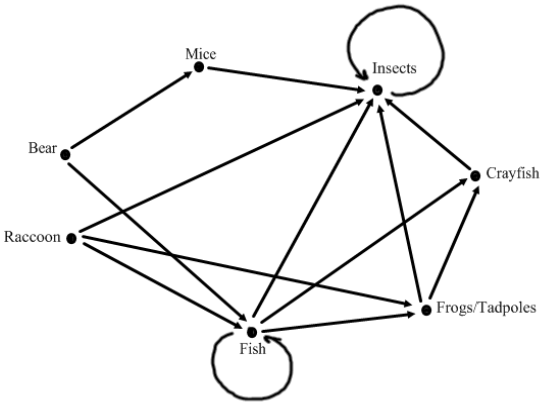
11. 1, 4, 7, 10, … _____ c) $t_n = 3n^2$ for $n = 1, 2, 3,\ldots$

12. 1, 6, 11, 16, … _____ d) $t_1 =$ _____, $t_{n+1} = -3 \cdot t_n$

13. The population of flies in Mr. Bunn's classroom doubles every 5 days. If there were 10 flies on the first day of school, when will the population reach 2,000,000?

14. Determine the minimum time required to complete all the activities shown in the graph.





15. Construct the associated(adjacency) matrix F to represent this web. What does a row containing a single one indicate? What does a column of zeros indicate?

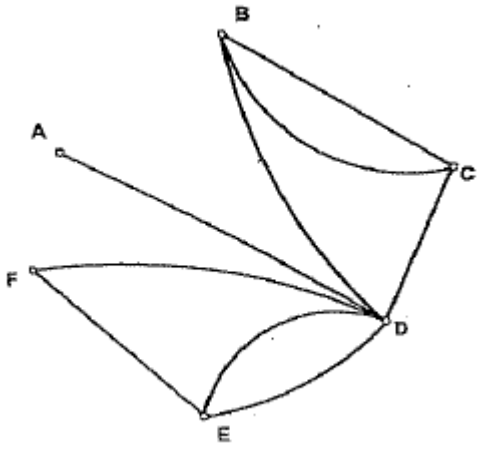
16. Give the first 5 terms of each sequence:

a) $a_n = 3n+ 4$ if $n = 1, 2, 3, \ldots$

b) $a_1 = 3$ and $a_n = a_{n-1} - 2$

17. If a job pays $44,000 per year, what would be the estimated monthly after-tax income if you are required to pay 15% in federal income tax, 6.2% SSN, and 1.45% for Medicare?

18. Which of the following is the adjacency matrix for the graph below?



a.

	A	B	C	D	E	F
A	1	0	0	1	0	0
B	0	0	1	1	0	0
C	0	2	0	2	0	0
D	1	1	1	0	2	1
E	0	0	0	2	0	1
F	0	0	0	1	1	0

b.

	A	B	C	D	E	F
A	0	0	0	1	0	0
B	1	0	1	1	0	0
C	0	2	0	2	0	0
D	1	1	1	0	2	0
E	0	0	0	2	0	1
F	0	0	0	1	1	0

c.

	A	B	C	D	E	F
A	0	0	0	1	0	0
B	1	0	1	1	0	0
C	1	2	0	2	0	0
D	0	1	1	0	2	0
E	2	0	0	2	0	1
F	0	0	0	1	1	0

d.

	A	B	C	D	E	F
A	0	0	0	1	0	0
B	0	0	2	1	0	0
C	0	2	0	1	0	0
D	1	1	1	0	2	1
E	0	0	0	2	0	1
F	0	0	0	1	1	0

19. The recurrence relation is $t_n = 3t_{n-1} + 1$. What is the value of t_n when $n = 4$?

a. 94
b. 31
c. 78
d. 124

n	t_n
1	3
2	
3	
4	
5	

20. A mail carrier is assigned a new section of town. Before heading out, he wants to determine the most efficient route that still allows him to visit each house and return to the post office without visiting a house twice.

a. Find such a route on the map below or explain why no such route exists.
(List the letters as you visit them or highlight the path using arrows to show direction.)