Unit 5:   The Mathematics of Informed Decision Making

Goal: To understand that informed decisions can be made on a mathematical basis.

Expectations

1.   analyze fairness in situations, such as proportional representation, division of property, and the allocation of resources.

Example:
A student committee is to be selected to give advice to the principal. There are to be 20 students on the committee. The school has 575 seniors, 500 juniors, 365 sophomores, and 405 freshmen. How should the twenty committee members be proportionally allocated among the classes?

Example:
A woman has a house worth $320,000, a car worth $65,000, and $100,000 in cash. When she died, her wishes were that each of her four children share equally in her property. One of the children wishes to keep the car, and another would like to keep the house. How could the property be divided?

Example:
A company that has gone bankrupt has had its assets liquidated into cash, totaling 1 million dollars. This will be used to pay off three creditors. Creditor A is owed 1.5 million dollars, creditor B is owed 600 thousand dollars, while creditor C is owed 300 thousand dollars. What is the fairest way to allocate the 1 million dollars among the three companies?

2.   evaluate various selection processes, such as majority rule, weighted voting, or pair-wise voting, to determine which process is appropriate in a given situation.

Example:
An election is held to determine the theme for the senior prom from one of three choices: Theme A, Theme B, and Theme C. Students were asked to rank the three themes from most favorite to least favorite. Here are the results of the voting.

Ballot (in order from most to least favorite)	Number of Votes
Theme A, Theme B, Theme C	42
Theme A, Theme C, Theme B	25
Theme B, Theme A, Theme C	12
Theme B, Theme C, Theme A	30
Theme C, Theme A, Theme B	18
Theme C, Theme B, Theme A	45

Based on this voting, which should be the prom theme: A, B, or C?

Example:
In a certain country's representative branch, the Yellow Party has 49 representatives, the Purple Party has 48 representatives, and the Olive Party has three representatives. How much power does the Olive Party have?

3. determine and analyze an appropriate model to solve problems involving population growth, vaccines, medication expiration dates, and medication dosages.

Example:
A person starts taking a medication whose dose is 600 mg every 8 hours. After 8 hours, exactly half of the medication remains in the bloodstream. After one week of consistently taking the medication, how much of the medication is in the bloodstream before and after taking a dose? After one week, you miss a dose. What effect does missing the dose have on the amount of medication in the bloodstream?

Example:
You look in your medicine cabinet and find a bottle of tablets that relieve allergy symptoms. The expiration date on the bottle is June 2008. Will the medicine still be effective? Is it safe to take the medicine? What information is needed to determine whether or not the medicine is still effective?

Example:
According to the United States Census Bureau, in December 2008, the United States averaged one birth every eight seconds, one death every 12 seconds, and a net immigration of one person every 36 seconds. Based on this information, what is the average number of seconds for the population of the United States to increase by one person? By how many people will the population of the United States increase in the next year?

4. use mathematics to make and justify health decisions, such as drug testing, spread of disease, health care costs, and long-term care insurance.

Example:
In testing for AIDS, the current test can correctly diagnose the presence of AIDS 99.9% of the time and can correctly diagnose its absence 99.6% of the time. Determine the probability that a person whose test results are positive actually has AIDS. Determine the probability that a person who tests negative does not have AIDS.

Example:

Research how much it would cost you to purchase health insurance if your company does not provide it. Decide on the coverage (including deductibles) that you desire. What factors would you need to consider when deciding whether or not to purchase health care insurance?

Example:
Determine the annual cost of nursing home care. How would these costs be paid? Would it be practical to purchase long-term health insurance?

5.   determine and analyze appropriate models to solve problems involving nutrition and exercise.

Example:
Two people start a nutrition and exercise program. A 200 pound man walks at 5 mph for 30 minutes a day, while a 130 pound woman runs at 8 mph for an hour each day. Which person burns the most calories by exercising?

6.   apply weighted averages to solve problems involving medication and school grade point averages.

Example:
A person is required to take an average daily dose of 325 mg of a medication. The medication is produced in pills of 125mg and 150 mg. How should the medication be taken so that the average daily dose, over time, is 325 mg?

Example:
Look at the following classes and grades by a student during a semester of high school:

Team Sports	B
Honors Precalculus	C
Chemistry	A
AP US History	B
Band	A
English 12	B

An A earns 4 points, a B earns three points, a C earns 2 points, a D earns 1 point, and an E earns no points. Honors courses earn an additional ½ point, while AP courses earn an additional point. What is this students' grade point average?