# Check Your Understanding
Situational Problem Review

This situational problem covers optimization (term 1), voting (term 3) and probability (term 3). Please make sure you understand all the questions in this packet and that you have an up-to-date memory aid (maximum of 1 page, front and back).

Key Concepts	Questions
Optimization	
Complete Optimization	1
Voting	
Plurality, Majority	2, 3
Majority with Elimination	4
Borda Count	4
Condorcet	4, 5
Probability	
Basic, And, Or	6, 7, 8
Expected Gain	7, 8
Fairness	8

1. Grade 11 students have decided to hold a bake sale in order to fundraise for prom. They will be selling cookies and brownies. The number of treats you can sell each day must adhere to the following constraints:

- You sell a maximum of 100 treats
- You sell at most of three times as many cookies as brownies
- You sell a minimum of 30 cookies
- You sell no more than 50 brownies

The students earn a profit of $1.50 for each cookie and $2 for each brownie. What is the maximum profit the students can earn each day?
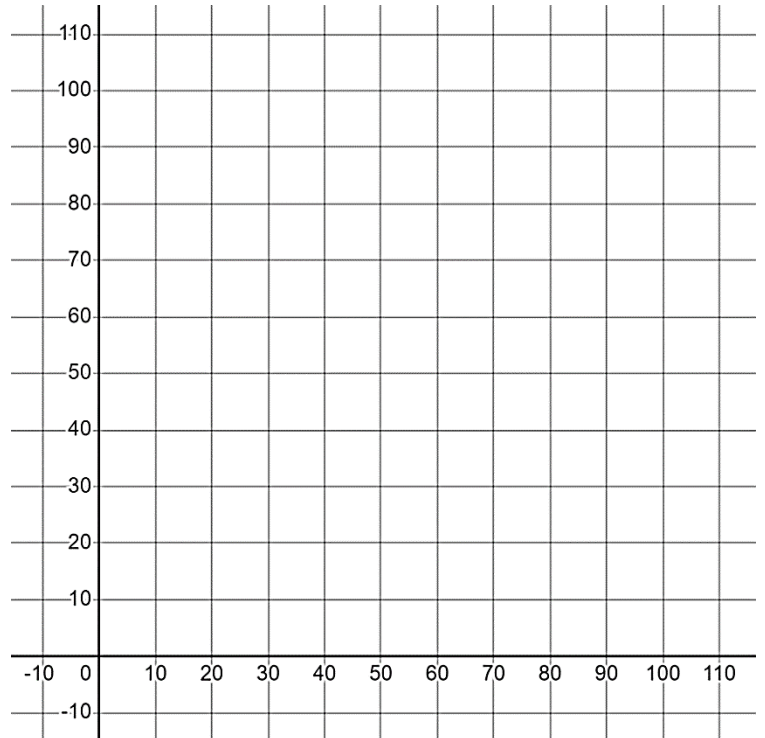
2. Four candidates are running in an election. The results are presented in the table below.

	450	800	670	330
1st	A	C	B	A
2nd	C	D	D	D
3rd	D	A	C	B
4th	B	B	A	C

A) Which candidate would win using majority?

B) Which candidate would win using plurality?

3. Four candidates are running in an election. The results are presented in the table below.

	300	850	250	270
1st	A	B	C	C
2nd	B	D	D	D
3rd	C	A	A	B
4th	D	C	B	A

Which candidate would win using majority?

4. Four candidates are running in an election. The results are presented in the table below.

	250	200	610	540
1st	A	B	C	D
2nd	D	A	D	C
3rd	C	C	B	A
4th	B	D	A	B

A) Which candidate would win using elimination?

B) Which candidate would win using Borda count?

C) Which candidate would win using Condorcet?

5. Four candidates are running in an election. The results are presented in the table below.

Which candidate would win using Condorcet?

	40	38	50	25
1st	D	A	B	C
2nd	A	C	C	D
3rd	B	B	D	A
4th	C	D	A	B

6. You pick a card from a standard deck of 52 cards and you roll a 6-sided die one time.

    a) Determine the probability of picking a red queen.

    b) Determine the probability of rolling a 3 or picking a club.

    c) Determine the probability of rolling an even number and picking a diamond.

7. You have designed a new carnival game. This game costs $7 to play. The player first spins a spinner, divided into 6 equal sections (red, blue, yellow, orange, green, purple) and then rolls a 6-sided die one time. To win $40, the player must roll a 2 and the spinner must land on purple. Determine the expected gain of this game and determine whether this game favors the player or the carnival.

8. You are playing a game where you must randomly choose a marble from a bag of marbles containing 18 blue marbles, 23 red marbles, and 59 yellow marbles. You then spin a spinner with 4 equal sections (blue, red, yellow, and green). The game costs $2 to play, and you win $7 if you pick a blue marble or the spinner lands on blue. Is this game fair?

ANSWER KEY

1) Max profit is $175
2) A) No winner   B) C wins
3) B wins
4) A) C wins   B) C winds   C) C wins
5) No winner
6) A) $\frac{1}{26}$ B) $\frac{3}{8}$ C) $\frac{1}{8}$
7) Expected gain is -5.89. The game favors the carnival.
8) The game is not fair because the expected gain is 0.695. To be fair the expected gain must equal 0.