

Infix	:	a + b
Prefix	:	+ a b
Postfix	:	a b +

Project: Post-Fixer

The aim of the project is to develop a one-player game about postfix expressions.

General Information

The game is played on a 10*10 board. Board elements are numbers (1-9) and 4 operations (*, +, /, -). These elements are added to the game from an input queue. The aim of the game is to form postfix expressions by using board elements and getting the highest score.

Main Game Components/Features

Board

Dimensions: 10*10

Board elements: 1-9 numbers, 4 operations (*, +, /, -)

There are 40 board elements on the board during the game.

Movement: Player moves the cursor on the board by using WASD keys.

Input Queue

Queue length: 8 elements (queue is always full)

Aim: Feeding board with elements when needed.

Stack

It is used for postfix expression evaluation.

Game Modes

1. Free walk mode (F key for mode): Player moves the cursor freely by using WASD keys.
2. Take symbols mode (T key for mode): Player takes symbols from the board to form a postfix expression.
3. Expression evaluation mode: Evaluates the postfix expression step by step by using the stack.

Active game duration (take mode) is 60 seconds. The board always has 40 symbols at the beginning of the take mode.

Score Calculation for the Postfix Expression

Expression score is calculated in 2 stages. In the first stage, score factor (n) must be calculated.

There are 2 types of symbols: Numbers (1-9) and operators (*, +, /, -)

For the calculation of the score factor (n);

- If the element is a number with more than one digit, then the score factor is 2 for each digit
- Else
 - If the symbol type is the same as the previous one, then the score factor is 1
 - If the symbol type is different from the previous one, then the score factor is 2

In the second stage, expression score is calculated according to the following formula.

Expression Score = $n * n$

Sample	Postfix Expression / Score Factors (n)	Score
1	5 8 * 1 + 1 + 2	4 * 4 = 16
2	9 59 8 + 41 * + 1 + 4 + 1 + 2 + 4 + 2 + 1	15 * 15 = 225

Game Operations for One Postfix Expression

1. The board always has 40 symbols at the beginning of the **take mode**. If less, symbols are taken from the input queue and then placed at random positions.
2. Active game duration is 60 seconds. Time counts down from 60 seconds at the beginning of the first **take mode**. Player spend time only in take mode. Other modes pause the time.
3. The game starts with **walk mode**. Player chooses the **take mode** (by pressing T) when he/she comes to the first symbol of the desired expression. So, the first symbol is taken and time countdown starts.
4. In **take mode**,
 - Player chooses one of the 4 directions. Cursor moves until it reaches the first symbol in that direction.
 - If the symbol is an operator, it is taken and game waits for another direction
 - If the symbol is a number, it is taken and continues to take number symbols until they finish. Cursor stays on the last number symbol. Taken number symbols are combined as one number with some digits.
 - Above operations are repeated for the next direction.
5. Player chooses the **free mode** (by pressing F) when he/she completes the expression. Time pauses. The postfix expression is evaluated step by step on the right side of the screen by using stack. The space bar is used to move to the next step of the evaluation.
6. The score of the postfix expression is calculated and added to the player's score. If the postfix expression is not a proper expression, player gets -20 penalty points.
7. Before the **free mode** starts, new symbols are added from the input queue to the board to reach 40 symbols.
8. Player walks around the board in **free mode** to form another expression.

Sample Game Steps

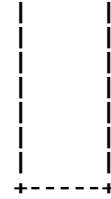
1234567890 ##### 1#/3-.5....*# 2#..*...../1# 3#1.661-3*..# 4#....4.+...# 5#../.....# 6#..5.-1../.# 7#.4.5...8..# 8#...5..9.8+# 9#.....# 0#.58.-.63..# #####	Input <<<<<<<< 94+/2*13 <<<<<<<<	Time : 60 Score: 0 Mode : Take	
1234567890 ##### 1#/3-.5....*# 2#..*...../1# 3#1.661-3*..# 4#....4.+...# 5#../.....# 6#..5.-1../.# 7#.4.8...8..# 8#...5..9.8+# 9#.....# 0#.58.-.63..# #####	Input <<<<<<<< 94+/2*13 <<<<<<<<	Time : 59 Score: 0 Mode : Take	
1234567890 #####	Input <<<<<<<<	Time : 58 Score: 0	

1#/3-.5....*#
2#..*...../1#
3#1.661-3...#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#...5..9.8+#
9#.....#
0#.58.-.63..#
#####

94+/2*13
<<<<<<<<

Mode : Evaluation

Expression: 5 8 *
Evaluation: 5 8 *



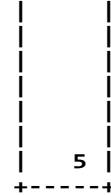
1234567890

1#/3-.5....*#
2#..*...../1#
3#1.661-3...#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#...5..9.8+#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
94+/2*13
<<<<<<<<

Time : 58
Score: 0
Mode : Evaluation

Expression: 5 8 *
Evaluation: 8 *



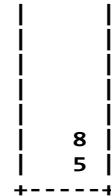
1234567890

1#/3-.5....*#
2#..*...../1#
3#1.661-3...#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#...5..9.8+#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
94+/2*13
<<<<<<<<

Time : 58
Score: 0
Mode : Evaluation

Expression: 5 8 *
Evaluation: *



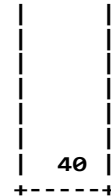
1234567890

1#/3-.5...+.*#
2#..*...../1#
3#1.661-3..4#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#..95..9.8+#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 58
Score: 16
Mode : Free

Expression: 5 8 *
Evaluation:



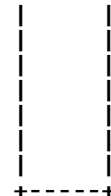
1234567890

1#/3-.5...+.*#
2#..*...../1#
3#1.661-3..4#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#..95..9.8+#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 57
Score: 16
Mode : Take

Expression: 9



1234567890
#####

Input
<<<<<<<<

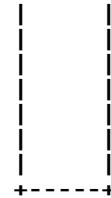
Time : 56
Score: 16

1#/3-.5..+.*#
2#..*...../1#
3#1.661-3..4#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#..95.....8+#
9#.....#
0#.58.-.63..#
#####

/2*13++5
<<<<<<<<

Mode : Take

Expression: 9 59



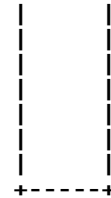
1234567890

1#/3-.5..+.*#
2#..*...../1#
3#1.661-3..4#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#.....8+#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 55
Score: 16
Mode : Take

Expression: 9 59 8



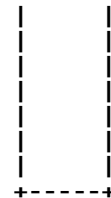
1234567890

1#/3-.5..+.*#
2#..*...../1#
3#1.661-3..4#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#.....+
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 54
Score: 16
Mode : Take

Expression: 9 59 8 +



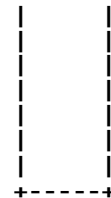
1234567890

1#/3-.5..+.*#
2#..*...../1#
3#1.661-3..4#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#.....#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 53
Score: 16
Mode : Take

Expression: 9 59 8 + 41



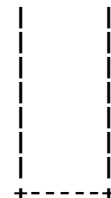
1234567890

1#/3-.5..+.*#
2#..*...../1#
3#1.661-3..4#
4#....4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#.....#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 52
Score: 16
Mode : Take

Expression: 9 59 8 + 41



1234567890
#####

Input
<<<<<<<<

Time : 51
Score: 16

1#/3-.5..+.#
2#..*...../.#
3#1.661-3...#
4#...4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#.....#
9#.....#
0#.58.-.63..#
#####

/2*13++5
<<<<<<<<

Mode : Take

Expression: 9 59 8 + 41 *

|
|
+-----+

1234567890

1#/3-.5..+.#
2#..*...../.#
3#1.661-3...#
4#...4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#.....#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 51
Score: 16
Mode : Evaluation

Expression: 9 59 8 + 41 * +
Expression: 9 59 8 + 41 * +

|
|
+-----+

1234567890

1#/3-.5.....#
2#..*...../.#
3#1.661-3...#
4#...4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#.....#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 51
Score: 16
Mode : Evaluation

Expression: 9 59 8 + 41 * +
Expression: 59 8 + 41 * +

|
|
9
+-----+

1234567890

1#/3-.5.....#
2#..*...../.#
3#1.661-3...#
4#...4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#.....#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 51
Score: 16
Mode : Evaluation

Expression: 9 59 8 + 41 * +
Expression: 8 + 41 * +

|
|
59
9
+-----+

1234567890

1#/3-.5.....#
2#..*...../.#
3#1.661-3...#
4#...4.+...#
5#../.....#
6#..5.-1../.#
7#.4.....#
8#.....#
9#.....#
0#.58.-.63..#
#####

Input
<<<<<<<<
/2*13++5
<<<<<<<<

Time : 51
Score: 16
Mode : Evaluation

Expression: 9 59 8 + 41 * +
Expression: + 41 * +

|
|
8
59
9
+-----+

1234567890
#####

Input
<<<<<<<<

Time : 51
Score: 16

1#/3-.5.....#	/2*13++5	Mode : Evaluation	
2#..*...../..#	<<<<<<<<		
3#1.661-3...#			
4#...4.+...#			
5#..../.....#			
6#..5.-1../..#			
7#.4.....#	Expression: 9 59 8 + 41 * +		67
8#.....#	Expression: 41 * +		9
9#.....#			
0#.58.-.63..#			
#####			

1234567890	Input	Time : 51	
#####	<<<<<<<<	Score: 16	
1#/3-.5.....#	/2*13++5	Mode : Evaluation	
2#..*...../..#	<<<<<<<<		
3#1.661-3...#			
4#...4.+...#			
5#..../.....#			
6#..5.-1../..#			
7#.4.....#	Expression: 9 59 8 + 41 * +		41
8#.....#	Expression: * +		67
9#.....#			9
0#.58.-.63..#			
#####			

1234567890	Input	Time : 51	
#####	<<<<<<<<	Score: 16	
1#/3-.5.....#	/2*13++5	Mode : Evaluation	
2#..*...../..#	<<<<<<<<		
3#1.661-3...#			
4#...4.+...#			
5#..../.....#			
6#..5.-1../..#			
7#.4.....#	Expression: 9 59 8 + 41 * +		2747
8#.....#	Expression: +		9
9#.....#			
0#.58.-.63..#			
#####			

1234567890	Input	Time : 51	
#####	<<<<<<<<	Score: 241	
1#/3-.5.....#	47+ / +5-1	Mode : Free	
2#..*...*5../..#	<<<<<<<<		
3#1.661-3...#			
4#...4.+...#			
5#.+ / ...2..#			
6#..5.-1../..#			
7#.4..1...8.#	Expression: 9 59 8 + 41 * +		
8#...../...3#	Expression:		2756
9#..+.....#			
0#.58.-.63..#			
#####			