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2nd Term, A.Y. 2023-2024

In partial fulfillment

of the course

In CSARCH2 (S12)

Test Case Screenshots - Simulation Project

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March 23, 2024

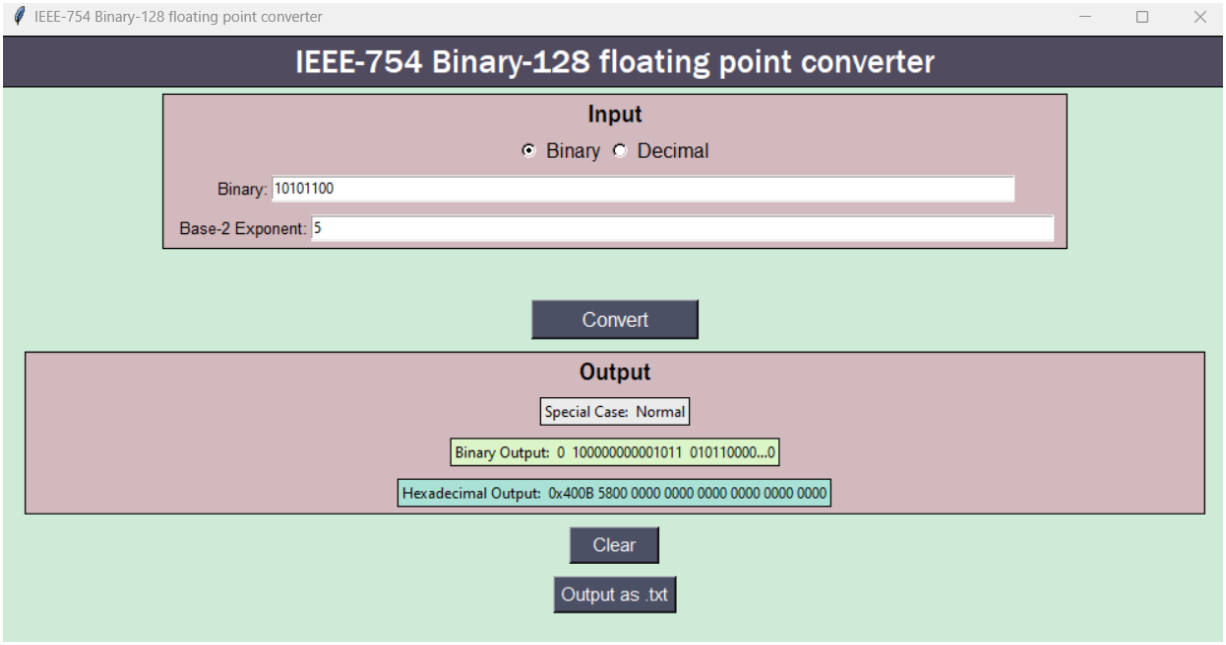
SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Binary to Binary-128 floating point conversion

Normal Binary Case: Positive Number	
Input Specification	***Solution***
Binary: 10101100 Base-2 Exponent: 5 Expected Binary Output: Sign bit = 0 Binary Exponent = 1000 0000 0000 1011 Binary Mantissa = 0101 1000 0...0 Expected Hex Output: 0x400B580...0	$10101100 * 2^{5}$ Normalize to: $1.0101100 * 2^{12}$ S = 0 E' = 12 + 16383 E' = 100000000001011 Hex output: 0x400B 5800 0000 0000 0000 0000 0000 0000

Screenshot

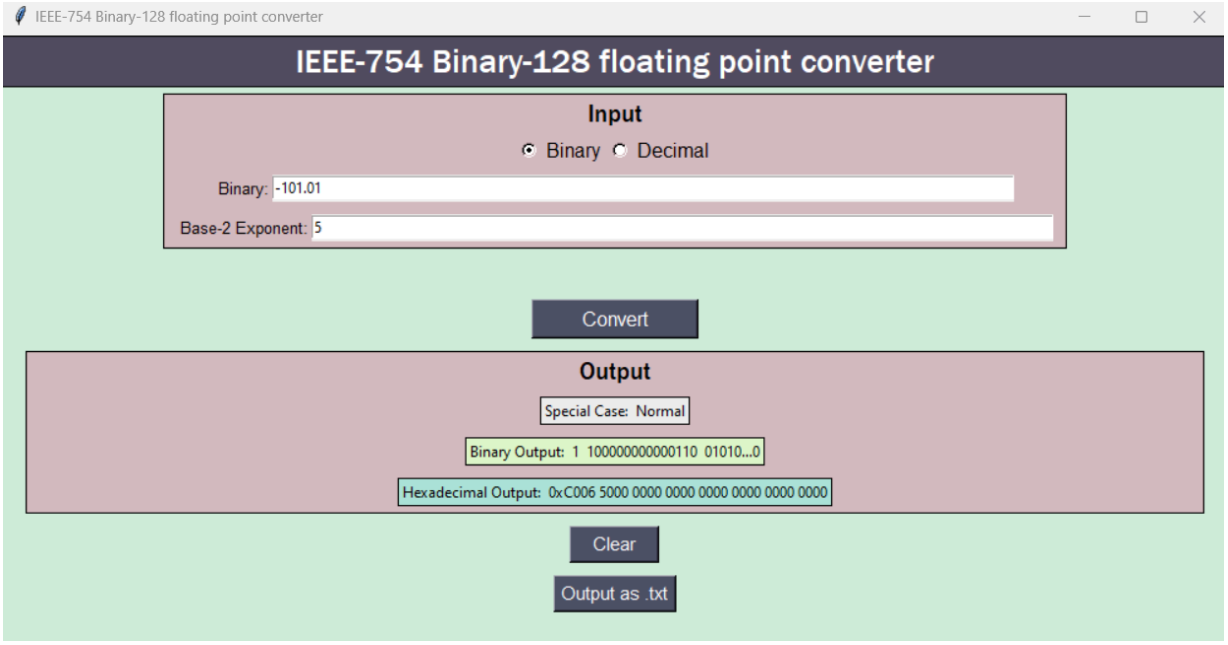


SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Normal Binary Case: Negative Number	
Input Specification	***Solution***
Binary: -101.01 Base-2 Exponent: 5 Expected Binary Output: Sign bit = 1 Binary Exponent = `100 0000 0000 0110` Binary Mantissa = `0101 0...0` Expected Hex Output: `0xC00650...0`	$-\ 101.01\ *\ 2^{5}$ Normalize to: $-\ 1.0101x2^{7}$ S = 1 E' = 7 + 16383 E' = `100000000000110` Hex output: `0xC006 5000 0000 0000 0000 0000 0000 0000`

Screenshot



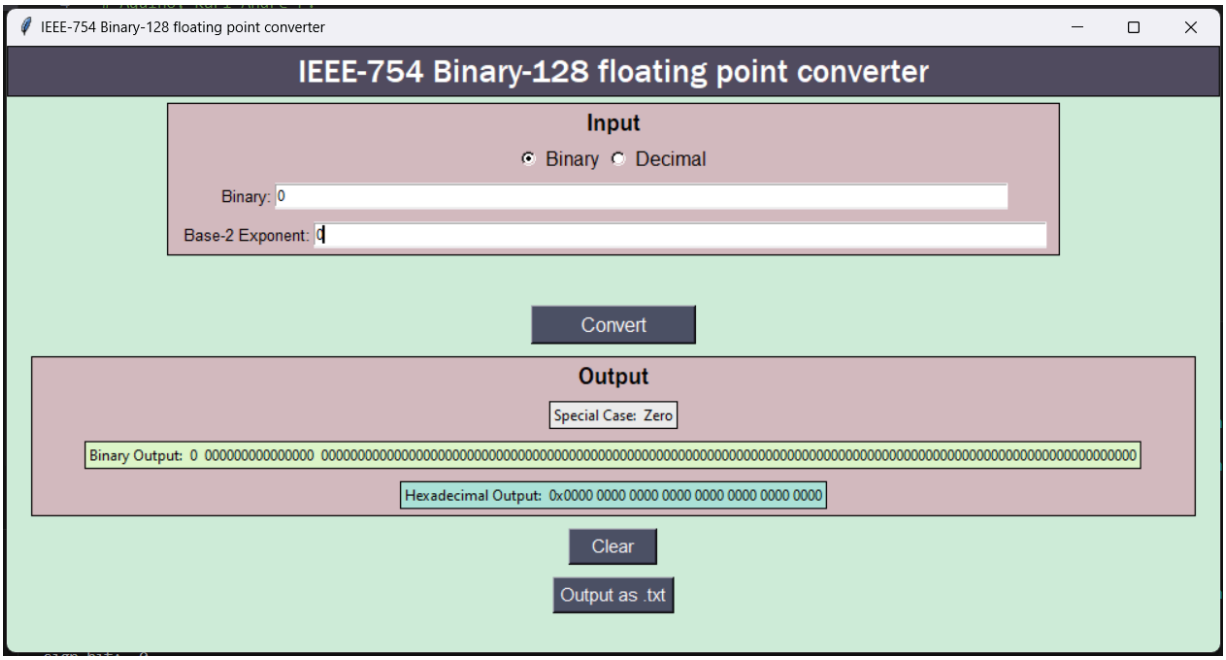
Special Binary Case: Zero

SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Input Specification	***Solution***
Binary: 0 Base-2 Exponent: 0 Expected Binary Output: Sign bit = 0 Binary Exponent = 000000000000000 Binary Mantissa = 0000 0000 0000 000…0 Expected Hex Output: 0x0000 0000 0000 0000….0	$0 * 2^{0} = 0$ Special Case: + Zero S = 0 E' = 000000000000000 Binary Mantissa = 0…0 Hex output : 0x0000 0000 0000 0000…. 0

Screenshot



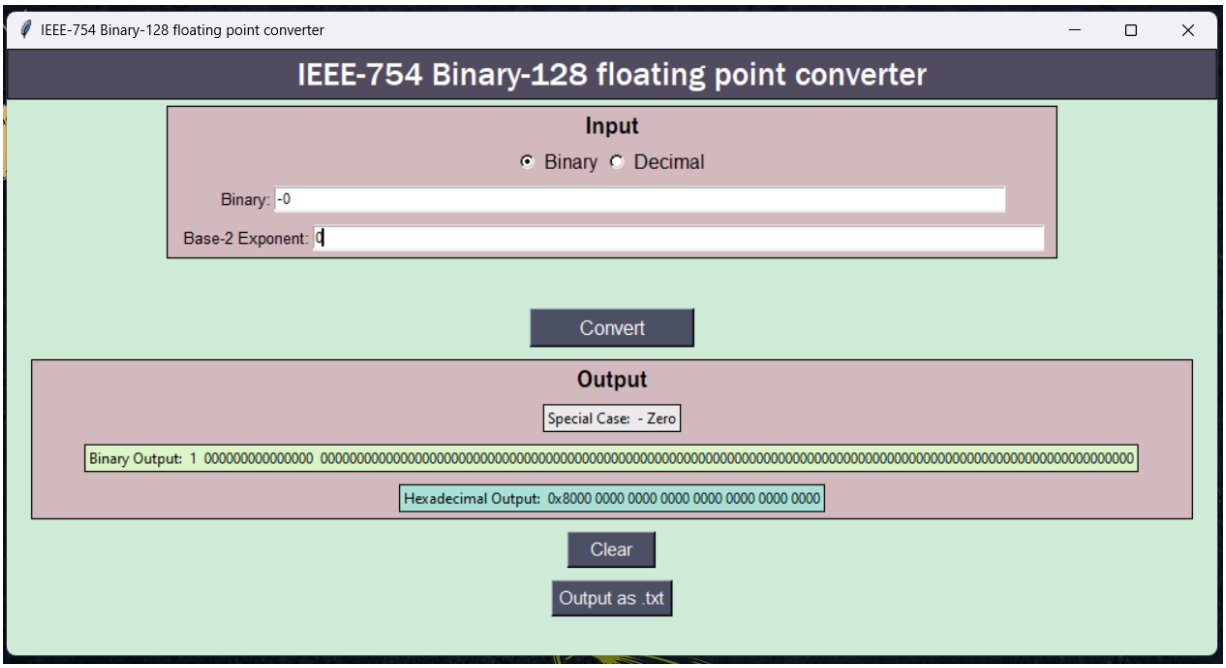
Special Binary Case: Negative Zero

SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Input Specification	***Solution***
Binary: -0 Base-2 Exponent: 0 Expected Binary Output: Sign bit = 1 Binary Exponent = 000000000000000 Binary Mantissa = 0000 0000 0000 000…0 Expected Hex Output: 0x8000 0000 0000 0000….0	$-\ 0^{*}\ 2^{0}$ = -0 = 0 Special Case: - Zero S = 1 E' = `000000000000000` Binary Mantissa = `0…0` Hex output: `0x8000 0000 0000 0000….0`

Screenshot



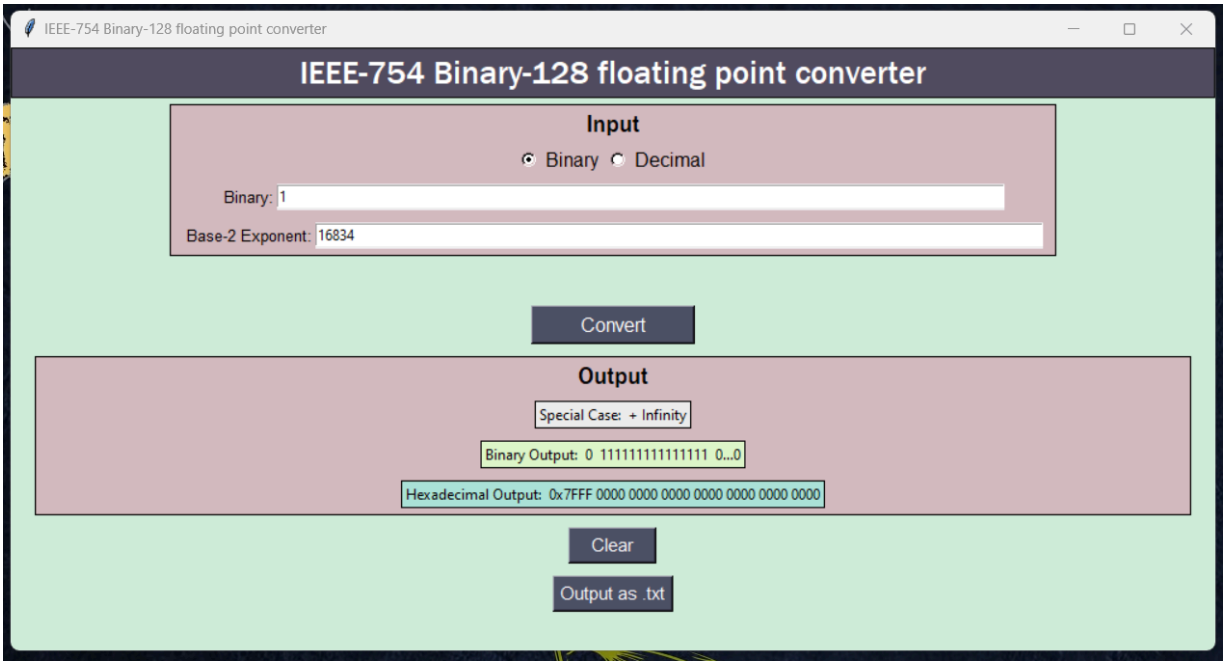
Special Binary Case: Infinity

SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Input Specification	***Solution***
Binary: 1 Base-2 Exponent: 16834 Expected Binary Output: Sign bit = 0 Binary Exponent = 11111……1 Binary Mantissa = 000……0 Expected Hex Output: 0x7FFF 0000 0000 0000 0000 0000 0000 0000	$1 * 2^{16834}$ S = 0 E' = 16834 + 16383 E' = 100000000000000 Special Case: + Infinity Converted to E' = 111111111111111 Hex output: 0x7FFF 0000 0000 0000 0000 0000 0000 0000

Screenshot



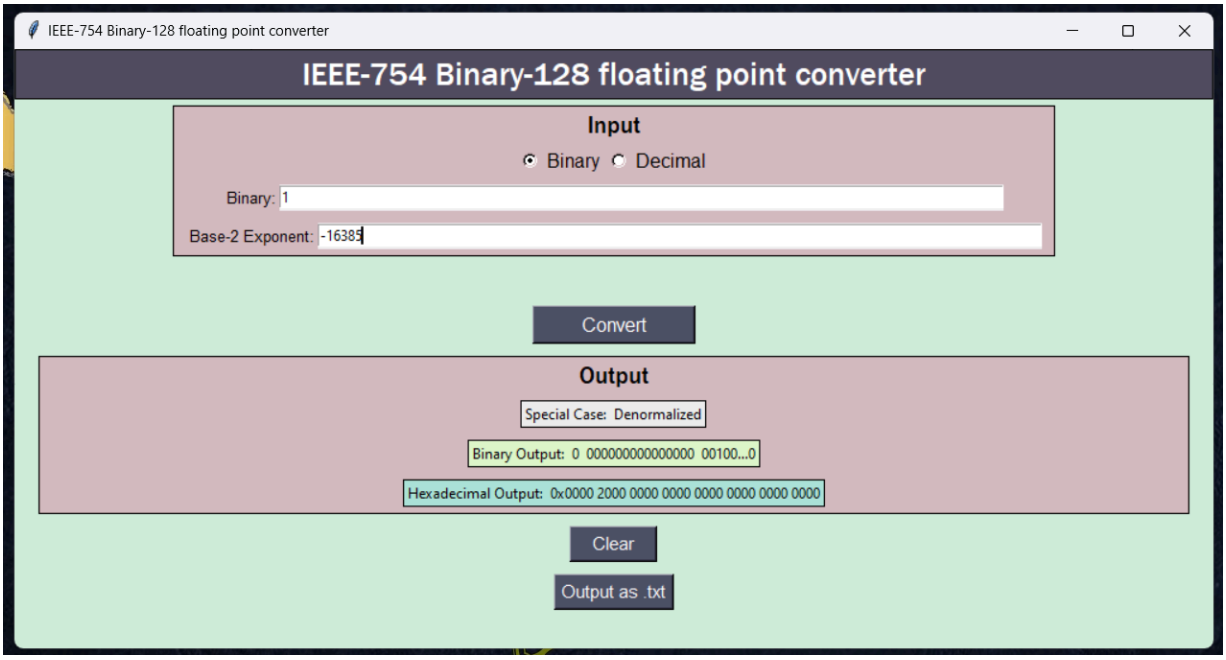
Special Binary Case: Very Small Number	
Input Specification	***Solution***

SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Binary: 1 Base-2 Exponent: -16385 Expected Binary Output: Sign bit = 0 Binary Exponent = 0 Binary Mantissa = 0010 0….0 Expected Hex Output: 0x0000 2000 0000 0000 0000 0000 0000 0000	$1 * 2^{-16835}$ S = 0 E' = $-\ 16835\ +\ 16383$ E' = $-\ 2$ Special Case: Denormalized Denormalize: $0.001 * 2^{-1682}$ E' = `000000000000000` Binary Mantissa = `0010…0` Hex output: `0x0000 2000 0000 0000 0000 0000 0000 0000`

Screenshot



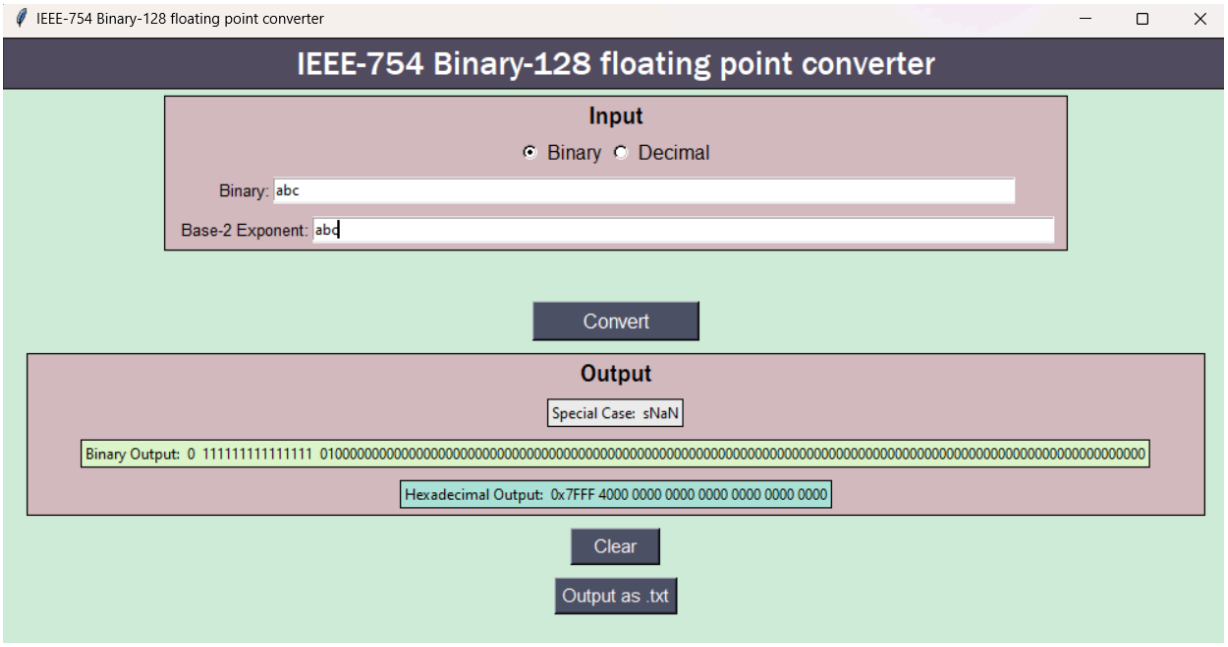
Special Binary Case: sNaN	
Input Specification	***Solution***
Binary: alphabet	$abc * 2^{-abc}$

SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Base-2 Exponent: alphabet Expected Binary Output: Sign bit = 0 Binary Exponent = 11111…1 Binary Mantissa = 0100 00..0 Expected Hex Output: 0x7FFF 4000 0000 0000 0000 0000 0000 0000	This will result in an invalid operation. This will be represented as sNaN. Special Case: sNaN S = 0 E' = 11111…1 Binary Mantissa = 0100 0…0 Hex Output: 0x7FFF 4000 0000 0000 0000 0000 0000 0000

Screenshot



Special Binary Case: qNaN	
Input Specification	***Solution***
Binary: sqrt(-1) Base-2 Exponent:	$\sqrt{-1} * 2^1$ This involves an operation with complex

SIMULATION PROJECT: Test Case Screenshots

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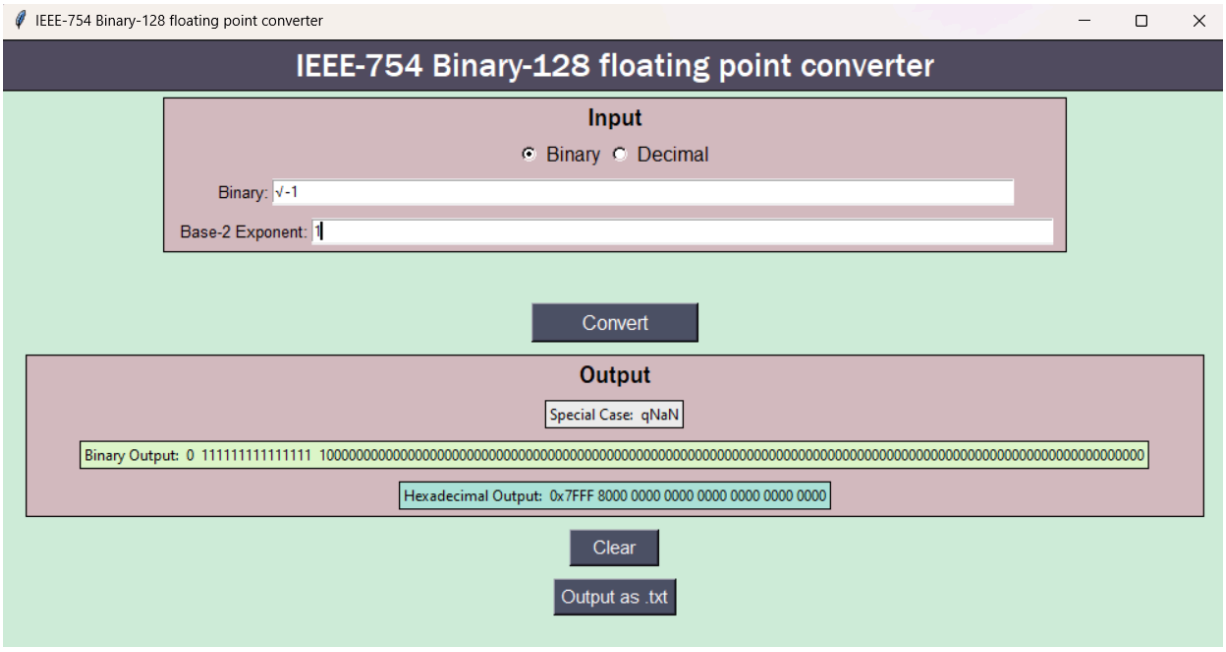
1 Expected Binary Output: Sign bit = 0 Binary Exponent = 11111…1 Binary Mantissa = 1000 00..0 Expected Hex Output: 0x7FFF 8000 0000 0000 0000 0000 0000 0000	numbers. This will be represented as qNaN. Special Case: qNaN S = 0 E' = 11111…1 Binary Mantissa = 1000 0…0 Hex Output: 0x7FFF 8000 0000 0000 0000 0000 0000 0000

Screenshot



SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Decimal to Binary-128 floating point conversion

<table>
<tr><th colspan="2">Normal Decimal Case: Positive Number</th></tr>
<tr><th>Input Specification</th><th>Solution</th></tr>
<tr><td>Decimal:
51

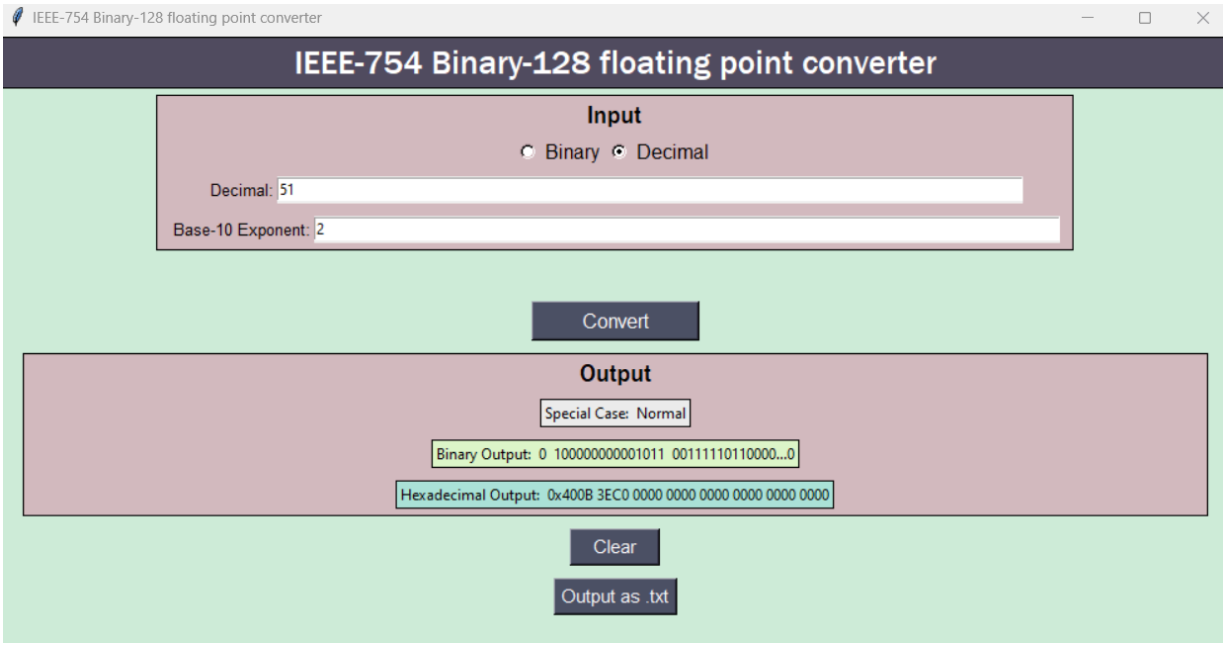
Base-10 Exponent:
2

Expected Binary Output:
Sign bit = 0
Binary Exponent = 100000000001011
Binary Mantissa = 0011 1110 1100 0...0

Expected Hex Output:
0x400B3EC0...0</td><td>$51 * 10^2 = 5100$

To Binary:
$1001111101100 * 2^0$

Normalize to:
$1.0011111011 * 2^{12}$

S = 0
E’ = 12 + 16383
E’ = 100000000001011
Binary Mantissa = 001111101100…0
Hex Output: 0x400B3EC0...0</td></tr>
<tr><td colspan="2">Screenshot
 
</td></tr>
</table>

SIMULATION PROJECT: Test Case Screenshots

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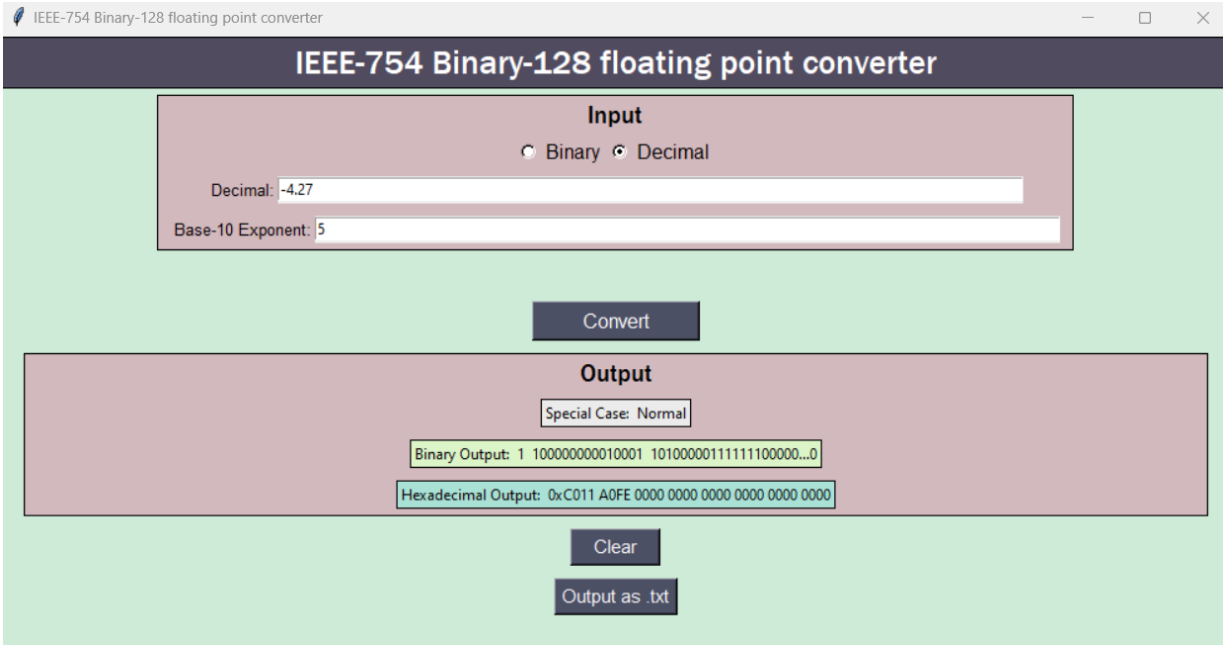
Normal Decimal Case: Negative Number	
Input Specification	***Solution***
Decimal: -4.27 Base-10 Exponent: 5 Expected Binary Output: Sign bit = 1 Binary Exponent = 100000000010001 Binary Mantissa = 1010 0000 1111 1110 0000 0...0 Expected Hex Output: 0xC011A0FE0...0	$-\ 4.27\ *\ 10^{5} =\ \ -\ 427000$ To Binary: $1101000001111111000\ *\ 2^{0}$ Normalize to: $1.10100001111111000x2^{18}$ S = 1 E' = 18 + 16383 E' = 100000000010001 Hex Output: 0xC011A0FE0...0

Screenshot



SIMULATION PROJECT: Test Case Screenshots

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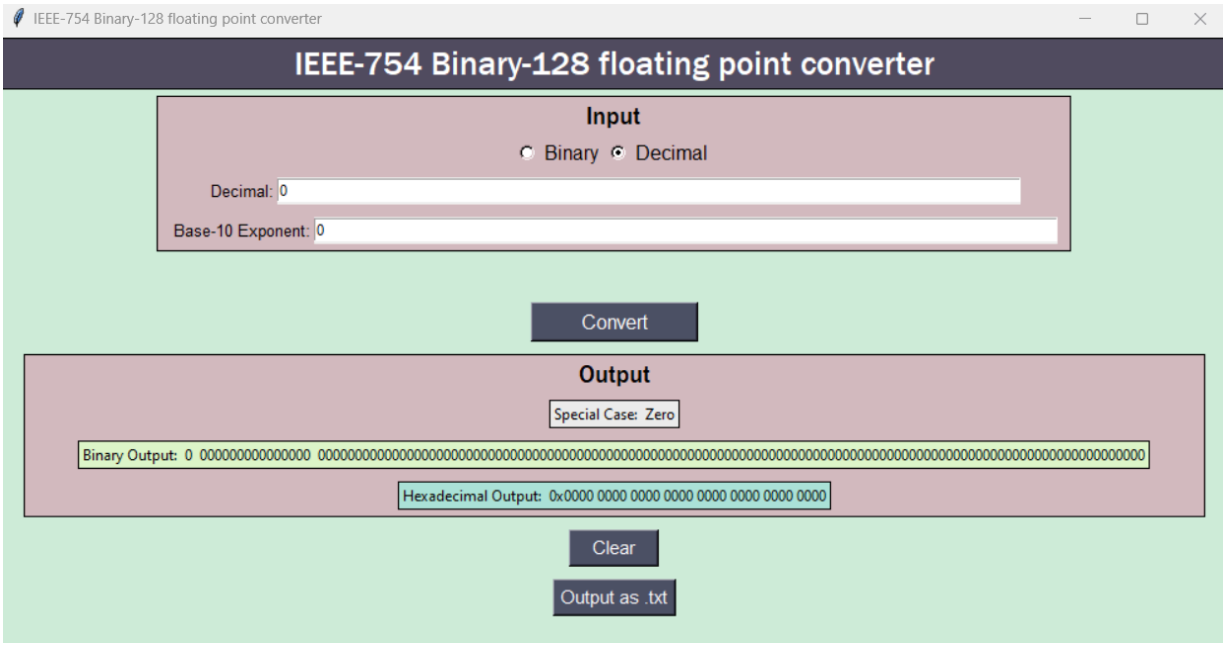
Special Decimal Case: Zero	
Input Specification	***Solution***

Decimal:
0
 	
Base-10 Exponent:
0
 	
Expected Binary Output:
Sign bit = `0`
Binary Exponent = `000000000000000`
Binary Mantissa =
`0000 0000 0000 000…0`
 	
Expected Hex Output:
`0x0000 0000 0000 0000….0`
	$0 * 10^{0} = 0$
	
	Special Case: + Zero
	
	S = `0`
	E' = `000000000000000`
	Binary Mantissa = `0…0`
	Hex Output: `0x0000 0000 … 0000`

Screenshot



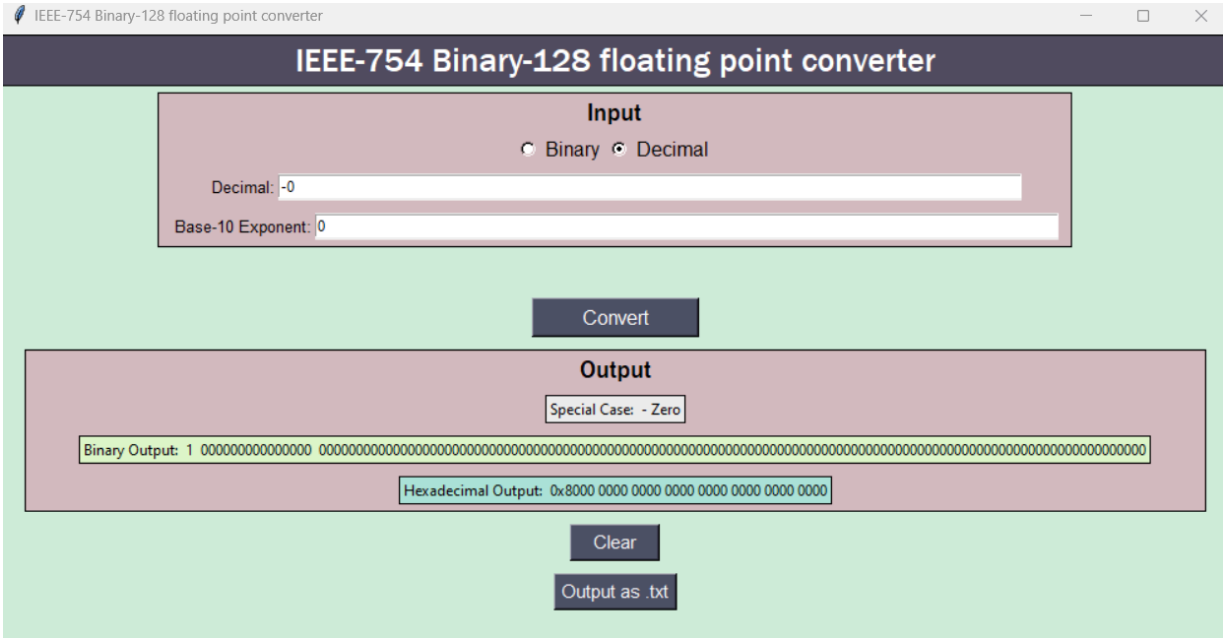
Special Decimal Case: Negative Zero

SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Input Specification	***Solution***
Decimal: -0 Base-10 Exponent: 0 Expected Binary Output: Sign bit = 1 Binary Exponent = `000000000000000` Binary Mantissa = `0000 0000 0000 000…0` Expected Hex Output: `0x8000 0000 0000 0000….0`	$-\ 0^{*}\ 10^{0}$ = -0 = 0 Special Case: - Zero S = 1 E' = `000000000000000` Binary Mantissa = `0…0` Hex Output: `0x8000 0000 … 0000`

Screenshot

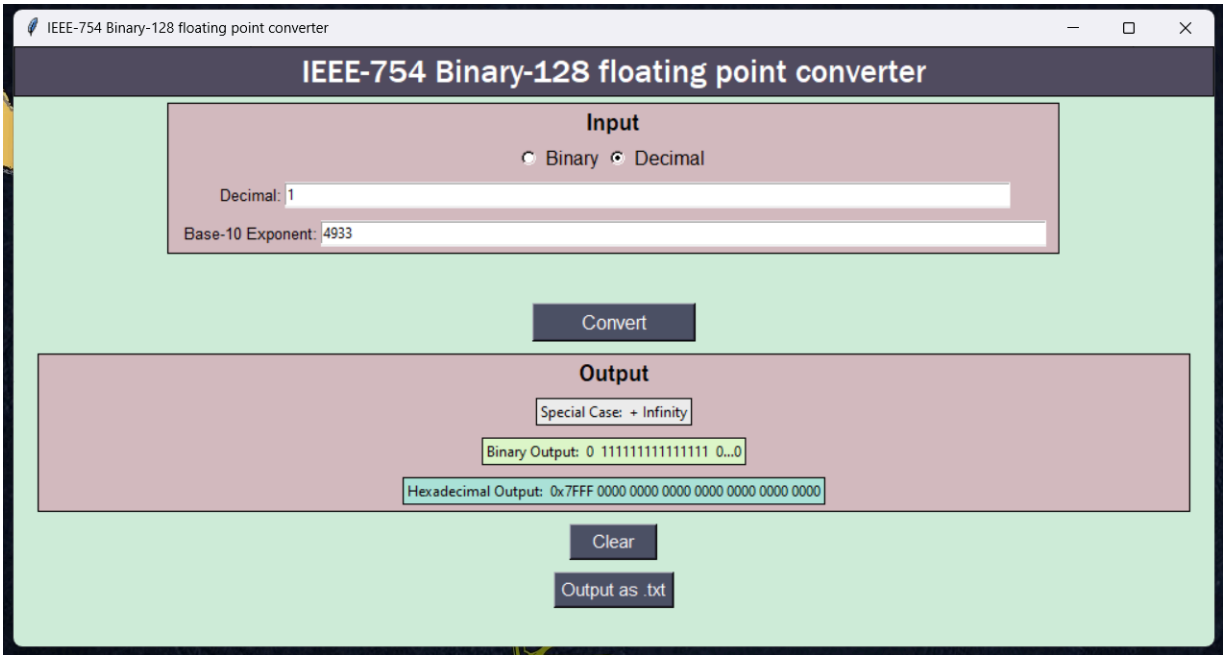


SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Special Decimal Case: Infinity	
Input Specification	***Solution***
Decimal: Base-10 Exponent: Expected Binary Output: Sign bit = `0` Binary Exponent = `111111111111111` Binary Mantissa = `00000….0` Expected Hex Output: `0x7FFF 0000 0000 0000 0000 0000 0000 0000`	$1 * 10^{4933}$ $\approx 1.00001100111110111111011 * 2^{16387}$ S = `0` E' = $16837 + 16383$ E' = `1000000111100010` Special Case: + Infinity Converted to: E' = `111111111111111` M = `00000….0`

Screenshot



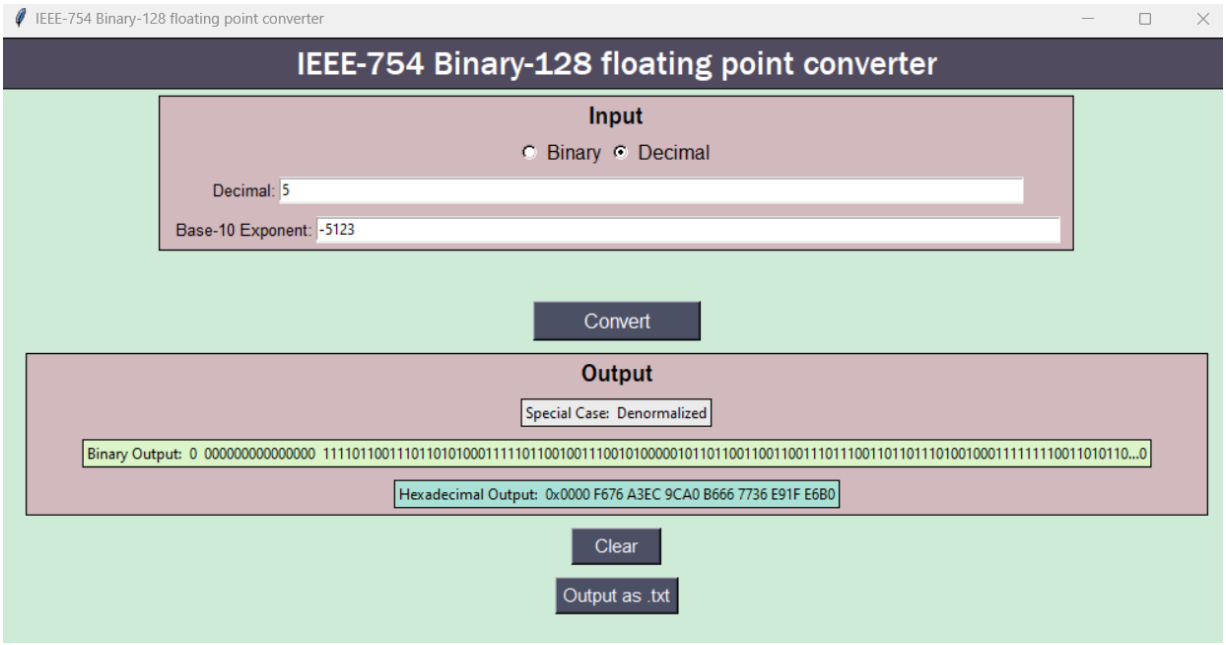
Special Decimal Case: Very Small Number	
Input Specification	***Solution***

SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Decimal: 5 Base-10 Exponent: -5123 Expected Binary Output: Sign bit = `0` Binary Exponent = `000000000000000` Binary Mantissa = `1111011001110110101~` Expected Hex Output: `0x0000 F676 A3EC 9CA0 B666 7736 E91F E6B0`	$5 * 10^{-5123}$ $\approx 1.11110110011101101010 01 * 2^{-17016}$ S = `0` E' = $-17016 + 16383 = -633$ Special Case: Denormalized E' = `000000000000000` Binary Mantissa = `1111011001110110101~` Hex output: `0x0000 F676 A3EC 9CA0 B666 7736 E91F E6B0`

Screenshot



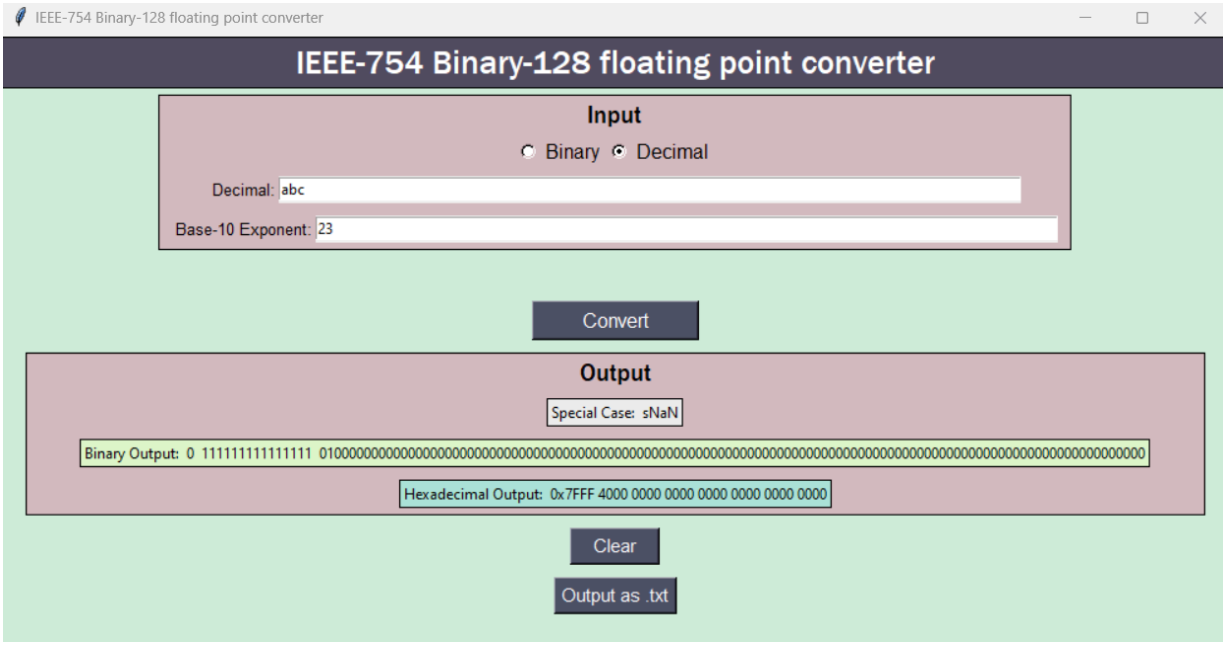
Special Decimal Case: sNaN	
Input Specification	***Solution***
Decimal: abc	$abc * 10^{23}$

SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Base-10 Exponent: 23 Expected Binary Output: Sign bit = `0` Binary Exponent = `11111` Binary Mantissa = `0100 0…0` Expected Hex Output: `0x7FFF 4000 0000 0000 0000 0000 0000 0000`	This will result in an invalid operation. This will be represented as sNaN. Special Case: sNaN S = `0` E' = `11111…1` Binary Mantissa = `0100 0…0` Hex Output: `0x7FFF 4000 0000 0000 0000 0000 0000 0000`

Screenshot



Special Decimal Case: qNaN	
Input Specification	***Solution***
Decimal: sqrt(-9) Base-10 Exponent: 2	$\sqrt{-9} * 10^{2}$ This involves an operation with complex numbers.

SIMULATION PROJECT: Test Case Screenshots

Aquino, Karl Andre; Apa, Giusippi Maria II ; Miranda, Bien Aaron; Rana, Luis Miguel; Tan, Edward James

Expected Binary Output: Sign bit = `0` Binary Exponent = `11111…1` Binary Mantissa = `1000 00..0` Expected Hex Output: `0x7FFF 8000 0000 0000 0000 0000 0000 0000`	This will be represented as qNaN. Special Case: qNaN S = `0` E' = `11111…1` Binary Mantissa = `1000 0…0` Hex Output: `0x7FFF 8000 0000 0000 0000 0000 0000 0000`

Screenshot