

# GetPauliString

```
SetDirectory @ NotebookDirectory[];  
Import["../Link/QuESTlink.m"];
```

## Doc

### ? GetPauliString

#### Symbol

Returns a Pauli string or a weighted sum of symbolic Pauli tensors from a variety of input formats.

GetPauliString[matrix] returns a complex-weighted sum of Pauli tensors

equivalent to the given matrix. If the input matrix is Hermitian, the output can

be passed to Chop[] in order to remove the negligible imaginary components.

GetPauliString[index] returns the basis Pauli string corresponding to the given index, where the returned Pauli operator targeting 0 is informed by the least significant bit(s) of the index.

GetPauliString[digits] specifies the Pauli product via the

base-4 digits of its index, where the rightmost digit is the least significant.

GetPauliString[address] opens or downloads the file at address (a string, of a file location or URL), and interprets it as a list of coefficients and Pauli codes. Each line of the file is assumed a separate Pauli tensor with format {coeff code1 code2 ... codeN} (excluding braces) where the codes are in {0,1,2,3} (indicating a I, X, Y, Z), for an N-qubit Pauli string, and are given in order of increasing significance (zero qubit left). Each line must have N+1 terms, which includes the initial real decimal coefficient. For an example, see "[https://qtechtheory.org/hamil\\_6qbLiH.txt](https://qtechtheory.org/hamil_6qbLiH.txt)".

GetPauliString[..., numQubits] overrides the inferred number of qubits, introducing additional Id operators upon un-targeted qubits (unless explicitly removed with "Removelds" -> False).

GetPauliString[..., {targets}] specifies a list of qubits which the returned Pauli string should target (in the given order), instead of the default targets {0, 1, 2, ...}.

GetPauliString accepts optional argument "Removelds" -> True or False

(default Automatic) which when True, retains otherwise removed Id operators

so that the returned string has an explicit Pauli operator acting upon every qubit.



# Correctness

## Matrix

### Floating-point

```
test[in_?MatrixQ] := Module[
  {out, check, error},
  out = GetPauliString[in];
  check = Simplify @ Normal @ CalcPauliExpressionMatrix[out];
  error = check - in // N // Abs // Chop // Max;
  Echo[out, "output: "];
  Echo[error, "error: "];
  If[error != 0, Style["ERRONEOUS PAULI STRING!", Red]]]
```

```
test @ RandomComplex[{1 + 1} {-10, 10}, {2, 2}]
```

» output:  $(-7.00668 + 3.19368 i) \text{Id}_0 + (7.81121 + 5.36322 i) X_0 -$   
 $(2.97788 + 0.498088 i) Y_0 + (0.333879 - 2.5949 i) Z_0$

» error: 0

```
test @ RandomComplex[{1 + 1} {-10, 10}, {8, 8}]
```

» output:  $(-2.49044 - 1.20806 i) \text{Id}_2 - (0.212075 + 1.1669 i) X_0 - (3.23189 + 1.79369 i) X_1 -$   
 $(1.54743 - 2.71099 i) X_0 X_1 + (4.15637 + 0.854116 i) X_2 - (1.23527 - 0.0508965 i) X_0 X_2 +$   
 $(0.891868 - 0.612764 i) X_1 X_2 - (1.52403 + 0.838172 i) X_0 X_1 X_2 + (0.810726 + 2.25201 i) Y_0 -$   
 $(2.35775 - 1.48545 i) X_1 Y_0 + (0.634575 - 4.4258 i) X_2 Y_0 + (0.727734 + 0.438274 i) X_1 X_2 Y_0 +$   
 $(0.208091 + 0.520604 i) Y_1 + (0.820052 + 2.33842 i) X_0 Y_1 + (4.15359 + 1.71228 i) X_2 Y_1 -$   
 $(1.93823 - 2.0618 i) X_0 X_2 Y_1 + (0.349336 + 1.39444 i) Y_0 Y_1 - (0.819729 + 2.57101 i) X_2 Y_0 Y_1 -$   
 $(0.373907 - 0.359999 i) Y_2 + (4.71596 + 0.25892 i) X_0 Y_2 - (0.672429 - 1.59888 i) X_1 Y_2 -$   
 $(2.72122 + 3.46905 i) X_0 X_1 Y_2 + (0.452538 - 1.14591 i) Y_0 Y_2 + (0.548713 - 0.0123168 i) X_1 Y_0 Y_2 -$   
 $(1.87275 - 1.98983 i) Y_1 Y_2 + (2.38408 + 0.0833225 i) X_0 Y_1 Y_2 - (0.50981 + 0.192193 i) Y_0 Y_1 Y_2 -$   
 $(2.74429 - 4.71331 i) Z_0 - (1.33776 + 1.29521 i) X_1 Z_0 + (1.74927 + 0.661787 i) X_2 Z_0 +$   
 $(3.87285 - 2.64535 i) X_1 X_2 Z_0 + (3.0244 + 0.206531 i) Y_1 Z_0 - (2.58112 + 3.28808 i) X_2 Y_1 Z_0 +$   
 $(0.512303 + 1.14665 i) Y_2 Z_0 - (0.0707985 - 0.0273257 i) X_1 Y_2 Z_0 +$   
 $(1.42501 + 2.64045 i) Y_1 Y_2 Z_0 - (1.75389 + 2.74997 i) Z_1 + (2.12932 - 0.0767908 i) X_0 Z_1 -$   
 $(1.71369 + 0.774871 i) X_2 Z_1 + (0.124729 + 0.777768 i) X_0 X_2 Z_1 - (0.101899 + 0.423164 i) Y_0 Z_1 -$   
 $(1.94578 + 2.28041 i) X_2 Y_0 Z_1 - (0.257175 - 1.95244 i) Y_2 Z_1 + (0.696273 - 1.38164 i) X_0 Y_2 Z_1 -$   
 $(2.66732 - 2.85036 i) Y_0 Y_2 Z_1 + (2.03809 - 1.21986 i) Z_0 Z_1 + (0.691456 + 0.474088 i) X_2 Z_0 Z_1 -$   
 $(6.0647 - 1.48904 i) Y_2 Z_0 Z_1 - (0.227803 - 1.40146 i) Z_2 - (2.18543 + 3.24923 i) X_0 Z_2 -$   
 $(0.909767 + 0.0661402 i) X_1 Z_2 + (2.65567 - 0.600581 i) X_0 X_1 Z_2 -$   
 $(1.72822 + 3.34217 i) Y_0 Z_2 - (3.11921 - 2.32638 i) X_1 Y_0 Z_2 + (0.219872 + 3.2526 i) Y_1 Z_2 -$   
 $(2.95911 + 1.3647 i) X_0 Y_1 Z_2 - (1.61726 - 2.62988 i) Y_0 Y_1 Z_2 - (1.10771 - 0.00761072 i) Z_0 Z_2 +$   
 $(0.934672 + 2.79614 i) X_1 Z_0 Z_2 + (3.78287 - 2.04935 i) Y_1 Z_0 Z_2 + (0.127662 - 1.51665 i) Z_1 Z_2 +$   
 $(4.86852 - 3.43825 i) X_0 Z_1 Z_2 + (1.84714 - 1.246 i) Y_0 Z_1 Z_2 - (1.36905 - 0.69544 i) Z_0 Z_1 Z_2$

» error: 0

```
test @ RandomReal[{-10, 10}, {4, 4}]
```

» **output:**  $1.14838 \text{Id}_1 + 3.85604 X_0 - 1.9814 X_1 + 1.75339 X_0 X_1 + (0. + 3.98919 \text{i}) Y_0 +$   
 $(0. + 2.92098 \text{i}) X_1 Y_0 - (0. + 4.86775 \text{i}) Y_1 - (0. + 1.84303 \text{i}) X_0 Y_1 -$   
 $4.72021 Y_0 Y_1 + 2.90106 Z_0 - 4.87751 X_1 Z_0 + (0. + 1.94828 \text{i}) Y_1 Z_0 -$   
 $2.33817 Z_1 + 0.142408 X_0 Z_1 - (0. + 0.746517 \text{i}) Y_0 Z_1 + 4.58818 Z_0 Z_1$

» **error:** 0

**hermitian = -i MatrixLog @ RandomVariate @ CircularUnitaryMatrixDistribution @ 4;**  
**test @ hermitian**

» **output:**  $(0.683874 + 2.2565 \times 10^{-17} \text{i}) \text{Id}_1 - (0.827743 - 5.55112 \times 10^{-17} \text{i}) X_0 -$   
 $(0.0245703 + 2.22045 \times 10^{-16} \text{i}) X_1 - (0.0405739 - 1.11022 \times 10^{-16} \text{i}) X_0 X_1 -$   
 $(0.249497 + 8.32667 \times 10^{-17} \text{i}) Y_0 - (0.453204 - 6.46184 \times 10^{-17} \text{i}) X_1 Y_0 +$   
 $(0.410178 - 2.42861 \times 10^{-16} \text{i}) Y_1 - (0.97914 - 5.29524 \times 10^{-16} \text{i}) X_0 Y_1 -$   
 $(0.0369672 + 3.33067 \times 10^{-16} \text{i}) Y_0 Y_1 + (0.301011 + 7.1266 \times 10^{-17} \text{i}) Z_0 +$   
 $(0.126721 + 1.11022 \times 10^{-16} \text{i}) X_1 Z_0 - (0.653224 + 1.249 \times 10^{-16} \text{i}) Y_1 Z_0 +$   
 $(0.294198 + 8.10441 \times 10^{-17} \text{i}) Z_1 + (0.0992372 + 2.77556 \times 10^{-17} \text{i}) X_0 Z_1 +$   
 $(0.0683445 + 8.32667 \times 10^{-17} \text{i}) Y_0 Z_1 - (0.191605 - 1.11273 \times 10^{-16} \text{i}) Z_0 Z_1$

» **error:** 0

**test @ Table[0., 2, 2]**

» **output:**  $0. + 0. \text{i}$

» **error:** 0

## Integer

**test @ RandomInteger[{-10, 10}, {2, 2}]**

» **output:**  $-\frac{7 \text{Id}_0}{2} + 8 X_0 - \text{i} Y_0 + \frac{11 Z_0}{2}$

» **error:** 0

**test @ RandomInteger[{-10, 10}, {4, 4}]**

» **output:**  $\frac{9 \text{Id}_1}{2} + X_0 - \frac{3 X_1}{4} - \frac{19 X_0 X_1}{4} - \frac{5 \text{i} Y_0}{2} - \frac{9}{4} \text{i} X_1 Y_0 + \frac{23 \text{i} Y_1}{4} +$   
 $\frac{11}{4} \text{i} X_0 Y_1 + \frac{7 Y_0 Y_1}{4} + Z_0 + \frac{3 X_1 Z_0}{4} + \frac{1}{4} \text{i} Y_1 Z_0 + 3 Z_1 + 4 X_0 Z_1 - \frac{1}{2} \text{i} Y_0 Z_1 + \frac{Z_0 Z_1}{2}$

» **error:** 0

**test @ Table[1, {i, 8}, {i, 8}]**

» **output:**  $\text{Id}_2 + X_0 + X_1 + X_0 X_1 + X_2 + X_0 X_2 + X_1 X_2 + X_0 X_1 X_2$

» **error:** 0

**test @ Table[0, {i, 8}, {i, 8}]**

» **output:** 0

» **error:** 0

**test[ IdentityMatrix[8] ]**

» **output:**  $\text{Id}_2$

» **error:** 0

## Symbolic

```
test @ {{a, b}, {c, d}}
```

» output:  $\frac{1}{2} (a + d) \text{Id}_0 + \frac{1}{2} (b + c) X_0 + \frac{1}{2} (i b - i c) Y_0 + \frac{1}{2} (a - d) Z_0$

» error: 0

```
test[ a IdentityMatrix[4] ]
```

» output:  $a \text{Id}_1$

» error: 0

```
test @ Table[a, {i, 8}, {i, 8}]
```

» output:  $a \text{Id}_2 + a X_0 + a X_1 + a X_0 X_1 + a X_2 + a X_0 X_2 + a X_1 X_2 + a X_0 X_1 X_2$

» error: 0

```
test @ RandomChoice[{a, b, c, d}, {4, 4}]
```

» output:  $\frac{1}{4} (2 a + b + c) \text{Id}_1 + \frac{1}{4} (2 b + c + d) X_0 + \frac{1}{4} (2 a + 2 d) X_1 +$   
 $\frac{1}{4} (a + b + c + d) X_0 X_1 + \frac{1}{4} (-i c + i d) Y_0 + \frac{1}{4} (-i a - i b + i c + i d) X_1 Y_0 +$   
 $\frac{1}{4} (i a - i b - i c + i d) X_0 Y_1 + \frac{1}{4} (a - b + c - d) Y_0 Y_1 + \frac{1}{4} (-b + c) Z_0 + \frac{1}{4} (-2 a + 2 d) X_1 Z_0 +$   
 $\frac{1}{4} (-2 a + b + c) Z_1 + \frac{1}{4} (2 b - c - d) X_0 Z_1 + \frac{1}{4} (i c - i d) Y_0 Z_1 + \frac{1}{4} (-b + c) Z_0 Z_1$

» error: 0

## numQubits

```
m = RandomInteger[{-10, 10}, {4, 4}];
```

```
GetPauliString[m, 5]
```

```
GetPauliString[m, 5, "RemoveIds" → True];
```

```
CalcPauliExpressionMatrix[%] == CalcPauliExpressionMatrix[%]
```

$\frac{7}{2} \text{Id}_0 \text{Id}_1 \text{Id}_2 \text{Id}_3 \text{Id}_4 - \frac{3}{4} \text{Id}_1 \text{Id}_2 \text{Id}_3 \text{Id}_4 X_0 + \frac{15}{4} \text{Id}_0 \text{Id}_2 \text{Id}_3 \text{Id}_4 X_1 - \frac{7}{4} \text{Id}_2 \text{Id}_3 \text{Id}_4 X_0 X_1 -$   
 $\frac{3}{4} i \text{Id}_1 \text{Id}_2 \text{Id}_3 \text{Id}_4 Y_0 + \frac{21}{4} i \text{Id}_2 \text{Id}_3 \text{Id}_4 X_1 Y_0 - \frac{1}{4} i \text{Id}_0 \text{Id}_2 \text{Id}_3 \text{Id}_4 Y_1 + \frac{9}{4} i \text{Id}_2 \text{Id}_3 \text{Id}_4 X_0 Y_1 -$   
 $\frac{13}{4} \text{Id}_2 \text{Id}_3 \text{Id}_4 Y_0 Y_1 - \frac{1}{2} \text{Id}_1 \text{Id}_2 \text{Id}_3 \text{Id}_4 Z_0 - \frac{1}{4} \text{Id}_2 \text{Id}_3 \text{Id}_4 X_1 Z_0 + \frac{19}{4} i \text{Id}_2 \text{Id}_3 \text{Id}_4 Y_1 Z_0 +$   
 $4 \text{Id}_0 \text{Id}_2 \text{Id}_3 \text{Id}_4 Z_1 + \frac{1}{4} \text{Id}_2 \text{Id}_3 \text{Id}_4 X_0 Z_1 + \frac{29}{4} i \text{Id}_2 \text{Id}_3 \text{Id}_4 Y_0 Z_1 - \text{Id}_2 \text{Id}_3 \text{Id}_4 Z_0 Z_1$

True

## targets

```

m = RandomInteger[{-10, 10}, {2, 2}];
GetPauliString[m]
GetPauliString[m, {5}]


$$2 \text{Id}_0 + \frac{9 X_0}{2} + \frac{5 \text{i} Y_0}{2} + 4 Z_0$$



$$2 \text{Id}_5 + \frac{9 X_5}{2} + \frac{5 \text{i} Y_5}{2} + 4 Z_5$$


m = RandomComplex[{-1 - \text{i}, 1 + \text{i}}, {4, 4}];
pA = GetPauliString[m];
mA = KroneckerProduct[CalcPauliExpressionMatrix[pA], IdentityMatrix[4]];
pB = GetPauliString[m, {2, 3}];
mB = CalcPauliExpressionMatrix[pB];

mA - mB // Abs // Max
0.

```

## Removelds

```

m = RandomInteger[{-10, 10}, {4, 4}];
GetPauliString[m];
GetPauliString[m, "RemoveIds" → False]
CalcPauliExpressionMatrix[%] == CalcPauliExpressionMatrix[%]


$$-\frac{15}{4} \text{Id}_0 \text{Id}_1 + \frac{23 \text{Id}_0 X_1}{4} - \frac{1}{2} \text{i} \text{Id}_1 Y_0 + 4 \text{i} X_1 Y_0 + \frac{3}{4} \text{i} \text{Id}_0 Y_1 + \frac{11}{2} \text{i} X_0 Y_1 +$$


$$\frac{Y_0 Y_1}{2} - \frac{3 \text{Id}_1 Z_0}{4} + \frac{5 X_1 Z_0}{4} - \frac{7}{4} \text{i} Y_1 Z_0 - \frac{3 \text{Id}_0 Z_1}{4} - \frac{5 X_0 Z_1}{2} - 3 \text{i} Y_0 Z_1 + \frac{25 Z_0 Z_1}{4}$$


True

```

---

## Index

```

GetPauliString[41 - 1]
GetPauliString[42 - 1]
GetPauliString[43 - 1]

Z0

Z0 Z1

Z0 Z1 Z2

GetPauliString[5]

X0 X1

```

## numQubits

```
GetPauliString[0]
GetPauliString[0, 2]
GetPauliString[0, 3]
Id0
Id0 Id1
Id0 Id1 Id2
```

## targets

```
GetPauliString[0]
GetPauliString[0, {52}]
Id0
Id52

GetPauliString[123]
GetPauliString[123, {9, 8, 7, 6}]
X3 Y1 Z0 Z2
X6 Y8 Z7 Z9

GetPauliString[3, 3, {1, 2, 3}]
Id2 Id3 Z1
```

## Removelds

```
GetPauliString[4, "RemoveIds" → False]
Id0 X1

GetPauliString[0, 5, "RemoveIds" → False]
Id0 Id1 Id2 Id3 Id4

GetPauliString[56 921, 10, "RemoveIds" → False]
Id8 Id9 X0 X2 X3 X6 Y1 Y4 Z5 Z7

GetPauliString[0, "RemoveIds" → True]
Id0

GetPauliString[0, 5, "RemoveIds" → True]
Id4

GetPauliString[1, "RemoveIds" → True]
X0
```

## Digits

```
GetPauliString[{0, 0, 0}]
```

$\text{Id}_0$

```
GetPauliString[{0, 0, 0}, 4]
```

$\text{Id}_0 \text{Id}_1 \text{Id}_2 \text{Id}_3$

```
GetPauliString[{0, 0, 0}, 4, "RemoveIds" → True]
```

$\text{Id}_3$

```
GetPauliString[{1, 0, 0}, {1, 2, 3}]
```

$X_3$

## Address

### File

```
setTmpFile[str_] := (
  DeleteFile["tmp.txt"];
  WriteString["tmp.txt", str])
```

```
setTmpFile["12.3 0"];
```

```
GetPauliString["tmp.txt"]
```

$12.3 \text{Id}_0$

```
setTmpFile[".1 0 1 2 3"];
```

```
GetPauliString["tmp.txt"]
```

$0.1 X_1 Y_2 Z_3$

```
setTmpFile["99 0 1 2 3\n33 3 2 1 0"];
```

```
GetPauliString["tmp.txt"]
```

$33 X_2 Y_1 Z_0 + 99 X_1 Y_2 Z_3$

### URL

```
GetPauliString["https://qtechtheory.org/hamil_6qbLiH.txt"]
```

$-6.52209 \text{Id}_0 - 0.00168947 X_0 + 0.000335609 X_1 + 0.00233908 X_0 X_1 - 0.00518865 X_2 -$   
 $2.32678 \times 10^{-6} X_0 X_2 - 0.00238276 X_1 X_2 - 0.000333484 X_0 X_1 X_2 + 0.0561302 X_3 +$   
 $0.0000211588 X_0 X_3 + 0.0000198838 X_0 X_1 X_3 - 0.000133652 X_2 X_3 - 0.0000311241 X_1 X_2 X_3 +$   
 $0.000547046 X_4 + 0.00165752 X_3 X_4 - 0.00600013 X_0 X_3 X_4 - 0.00812442 X_2 X_3 X_4 +$   
 $0.000447423 X_5 - 0.0000517994 X_0 X_5 + 0.00019084 X_0 X_1 X_5 - 0.0000777401 X_2 X_5 -$   
 $0.0001908 X_1 X_2 X_5 - 0.00630859 X_3 X_5 + 0.0661688 X_4 X_5 + 0.0000169999 X_0 X_4 X_5 +$   
 $0.00634842 X_0 X_1 X_4 X_5 - 0.000177071 X_2 X_4 X_5 - 0.00636179 X_1 X_2 X_4 X_5 +$

$$\begin{aligned}
& 0.00562722 X_3 X_4 X_5 - 0.000346402 Y_0 Y_1 + 0.00448136 X_2 Y_0 Y_1 + 0.00115501 X_2 X_3 Y_0 Y_1 + \\
& 0.0000532277 X_2 X_3 X_4 Y_0 Y_1 - 4.65274 \times 10^{-6} X_2 X_5 Y_0 Y_1 + 0.00135462 X_2 X_4 X_5 Y_0 Y_1 - \\
& 0.000333484 X_1 Y_0 Y_2 - 0.000349657 Y_1 Y_2 - 0.00448136 X_0 Y_1 Y_2 - 0.00115501 X_0 X_3 Y_1 Y_2 - \\
& 0.0000532277 X_0 X_3 X_4 Y_1 Y_2 + 4.65274 \times 10^{-6} X_0 X_5 Y_1 Y_2 - 0.00135462 X_0 X_4 X_5 Y_1 Y_2 + \\
& 0.0000200195 X_1 Y_0 Y_3 - 0.00600159 X_4 Y_0 Y_3 - 0.0000200201 X_1 Y_2 Y_3 - 0.00811879 X_4 Y_2 Y_3 + \\
& 0.000605355 Y_0 Y_4 + 0.00218376 X_1 X_3 X_5 Y_0 Y_4 + 0.0000212508 X_3 X_5 Y_1 Y_4 + \\
& 0.000818909 Y_2 Y_4 - 0.00218383 X_1 X_3 X_5 Y_2 Y_4 + 0.00115327 Y_3 Y_4 - 0.0118593 X_5 Y_3 Y_4 - \\
& 6.82832 \times 10^{-6} X_0 X_5 Y_3 Y_4 - 0.00218371 X_0 X_1 X_5 Y_3 Y_4 + 0.0000425857 X_2 X_5 Y_3 Y_4 + \\
& 0.00218728 X_1 X_2 X_5 Y_3 Y_4 - 0.000359442 X_2 X_5 Y_0 Y_1 Y_3 Y_4 + 0.000359442 X_0 X_5 Y_1 Y_2 Y_3 Y_4 + \\
& 0.000135095 X_1 Y_0 Y_5 + 0.00605026 X_4 Y_0 Y_5 + 1.31465 \times 10^{-6} Y_1 Y_5 - 0.000135099 X_1 Y_2 Y_5 + \\
& 0.00818463 X_4 Y_2 Y_5 + 0.00562722 X_4 Y_3 Y_5 + 0.00262718 Y_4 Y_5 + 0.0118593 X_3 Y_4 Y_5 - \\
& 0.00207761 X_0 X_3 Y_4 Y_5 - 0.00286236 X_2 X_3 Y_4 Y_5 - 3.44924 \times 10^{-6} X_1 X_2 X_3 Y_4 Y_5 + \\
& 0.000359442 X_2 X_3 Y_0 Y_1 Y_4 Y_5 - 0.000359442 X_0 X_3 Y_1 Y_2 Y_4 Y_5 - 0.00208444 Y_0 Y_3 Y_4 Y_5 - \\
& 0.00281977 Y_2 Y_3 Y_4 Y_5 - 0.185375 Z_0 + 0.00317514 X_1 Z_0 - 0.000313619 X_2 Z_0 - \\
& 0.000349657 X_1 X_2 Z_0 - 0.0164168 X_3 Z_0 - 0.000593557 X_1 X_3 Z_0 - 0.000768553 X_3 X_4 Z_0 - \\
& 0.0000767563 X_1 X_3 X_4 Z_0 - 0.000758441 X_5 Z_0 + 0.0000287213 X_1 X_5 Z_0 - \\
& 0.02022 X_4 X_5 Z_0 - 0.000653789 X_1 X_4 X_5 Z_0 - 0.00238276 Y_1 Y_2 Z_0 - \\
& 0.000011104 X_3 Y_1 Y_2 Z_0 - 0.00628778 X_3 X_4 Y_1 Y_2 Z_0 - 0.0000557013 X_5 Y_1 Y_2 Z_0 - \\
& 0.000023046 X_4 X_5 Y_1 Y_2 Z_0 + 0.00628775 X_2 X_4 Y_1 Y_3 Z_0 - 0.000634219 X_2 Y_1 Y_4 Z_0 + \\
& 0.00524 X_5 Y_3 Y_4 Z_0 + 0.000176569 X_1 X_5 Y_3 Y_4 Z_0 + 3.44924 \times 10^{-6} X_5 Y_1 Y_2 Y_3 Y_4 Z_0 - \\
& 0.00633874 X_2 X_4 Y_1 Y_5 Z_0 - 0.00524 X_3 Y_4 Y_5 Z_0 - 0.00019782 X_1 X_3 Y_4 Y_5 Z_0 - \\
& 0.00218728 X_3 Y_1 Y_2 Y_4 Y_5 Z_0 + 0.00218383 X_2 Y_1 Y_3 Y_4 Y_5 Z_0 + 0.235213 Z_1 + \\
& 0.00168947 X_0 Z_1 + 0.00518865 X_2 Z_1 + 0.0644581 X_0 X_2 Z_1 - 2.04985 \times 10^{-6} X_0 X_3 Z_1 + \\
& 0.000159502 X_2 X_3 Z_1 - 1.45579 \times 10^{-6} X_0 X_3 X_4 Z_1 + 5.63004 \times 10^{-6} X_2 X_3 X_4 Z_1 + \\
& 0.00018075 X_0 X_5 Z_1 + 0.000252181 X_2 X_5 Z_1 + 0.00603326 X_0 X_4 X_5 Z_1 + \\
& 0.00836171 X_2 X_4 X_5 Z_1 + 0.0644557 Y_0 Y_2 Z_1 + 0.0000191089 Y_0 Y_3 Z_1 + \\
& 0.0000258501 Y_2 Y_3 Z_1 + 0.00208444 X_3 X_5 Y_0 Y_4 Z_1 + 0.00281977 X_3 X_5 Y_2 Y_4 Z_1 - \\
& 0.00207761 X_0 X_5 Y_3 Y_4 Z_1 - 0.00286236 X_2 X_5 Y_3 Y_4 Z_1 + 0.00012895 Y_0 Y_5 Z_1 + \\
& 0.000174441 Y_2 Y_5 Z_1 - 6.82832 \times 10^{-6} X_0 X_3 Y_4 Y_5 Z_1 + 0.0000425857 X_2 X_3 Y_4 Y_5 Z_1 - \\
& 0.186609 Z_0 Z_1 + 0.000313619 X_2 Z_0 Z_1 - 0.0180857 X_3 Z_0 Z_1 - 0.00083422 X_3 X_4 Z_0 Z_1 - \\
& 0.000726068 X_5 Z_0 Z_1 - 0.0221369 X_4 X_5 Z_0 Z_1 + 0.00575159 X_5 Y_3 Y_4 Z_0 Z_1 - \\
& 0.00575159 X_3 Y_4 Y_5 Z_0 Z_1 - 0.408535 Z_2 + 0.000313609 X_0 Z_2 - 0.00317514 X_1 Z_2 - \\
& 0.000346402 X_0 X_1 Z_2 - 0.0154095 X_3 Z_2 + 0.000593752 X_1 X_3 Z_2 - 0.00072171 X_3 X_4 Z_2 + \\
& 0.0000155702 X_1 X_3 X_4 Z_2 - 0.000733397 X_5 Z_2 - 0.0000274067 X_1 X_5 Z_2 - 0.0190046 X_4 X_5 Z_2 + \\
& 0.000715471 X_1 X_4 X_5 Z_2 + 0.00233908 Y_0 Y_1 Z_2 + 0.00628708 X_3 X_4 Y_0 Y_1 Z_2 + \\
& 0.0000557449 X_5 Y_0 Y_1 Z_2 + 9.86353 \times 10^{-6} X_4 X_5 Y_0 Y_1 Z_2 - 0.00628756 X_0 X_4 Y_1 Y_3 Z_2 + \\
& 0.0006342 X_0 Y_1 Y_4 Z_2 + 0.00492191 X_5 Y_3 Y_4 Z_2 - 0.00019782 X_1 X_5 Y_3 Y_4 Z_2 + \\
& 0.00633855 X_0 X_4 Y_1 Y_5 Z_2 - 0.00492191 X_3 Y_4 Y_5 Z_2 + 0.000176569 X_1 X_3 Y_4 Y_5 Z_2 + \\
& 0.00218371 X_3 Y_0 Y_1 Y_4 Y_5 Z_2 - 0.00218376 X_0 Y_1 Y_3 Y_4 Y_5 Z_2 + 0.162106 Z_0 Z_2 - \\
& 0.000335609 X_1 Z_0 Z_2 - 0.0000611861 X_4 Y_1 Y_3 Z_0 Z_2 + 6.17159 \times 10^{-6} Y_1 Y_4 Z_0 Z_2 + \\
& 0.0000616823 X_4 Y_1 Y_5 Z_0 Z_2 - 0.0000212508 Y_1 Y_3 Y_4 Y_5 Z_0 Z_2 - 0.410254 Z_1 Z_2 - \\
& 0.000313609 X_0 Z_1 Z_2 - 0.0176676 X_3 Z_1 Z_2 - 0.000889543 X_3 X_4 Z_1 Z_2 - 0.000692702 X_5 Z_1 Z_2 - \\
& 0.0216777 X_4 X_5 Z_1 Z_2 + 0.00564146 X_5 Y_3 Y_4 Z_1 Z_2 - 0.00564146 X_3 Y_4 Y_5 Z_1 Z_2 + \\
& 0.226558 Z_0 Z_1 Z_2 - 0.284094 Z_3 - 0.000110504 X_0 Z_3 + 0.0000311764 X_0 X_1 Z_3 + \\
& 0.000473615 X_2 Z_3 + 0.0000119845 X_1 X_2 Z_3 - 0.00171463 X_4 Z_3 + 0.000604774 X_0 X_4 Z_3 + \\
& 0.000823784 X_2 X_4 Z_3 + 0.00306375 X_5 Z_3 + 0.00262718 X_4 X_5 Z_3 - 0.00443537 X_2 Y_0 Y_1 Z_3 - \\
& 0.0000466657 X_2 X_4 Y_0 Y_1 Z_3 + 0.00443537 X_0 Y_1 Y_2 Z_3 + 0.0000466657 X_0 X_4 Y_1 Y_2 Z_3 +
\end{aligned}$$



$$\begin{aligned}
& 0.00633855 X_1 X_5 Y_0 Y_4 Z_3 + 0.0000616823 X_5 Y_1 Y_4 Z_3 - 0.00633874 X_1 X_5 Y_2 Y_4 Z_3 + \\
& 0.0661688 Y_4 Y_5 Z_3 - 0.00603326 X_0 Y_4 Y_5 Z_3 + 9.86353 \times 10^{-6} X_0 X_1 Y_4 Y_5 Z_3 - \\
& 0.00836171 X_2 Y_4 Y_5 Z_3 - 0.000023046 X_1 X_2 Y_4 Y_5 Z_3 + 0.00135462 X_2 Y_0 Y_1 Y_4 Y_5 Z_3 - \\
& 0.00135462 X_0 Y_1 Y_2 Y_4 Y_5 Z_3 + 0.0630371 Z_0 Z_3 + 0.00227945 X_1 Z_0 Z_3 + 0.00057444 X_4 Z_0 Z_3 + \\
& 0.0000318528 X_1 X_4 Z_0 Z_3 + 0.0000119845 Y_1 Y_2 Z_0 Z_3 + 0.000634787 X_4 Y_1 Y_2 Z_0 Z_3 - \\
& 0.02022 Y_4 Y_5 Z_0 Z_3 - 0.000715471 X_1 Y_4 Y_5 Z_0 Z_3 - 0.00636179 Y_1 Y_2 Y_4 Y_5 Z_0 Z_3 + \\
& 0.000110504 X_0 Z_1 Z_3 - 0.000473615 X_2 Z_1 Z_3 - 4.8746 \times 10^{-6} X_2 X_4 Z_1 Z_3 + \\
& 0.00605026 X_5 Y_0 Y_4 Z_1 Z_3 + 0.00818463 X_5 Y_2 Y_4 Z_1 Z_3 - 0.0000169999 X_0 Y_4 Y_5 Z_1 Z_3 + \\
& 0.000177071 X_2 Y_4 Y_5 Z_1 Z_3 + 0.0694463 Z_0 Z_1 Z_3 + 0.000643489 X_4 Z_0 Z_1 Z_3 - \\
& 0.0221369 Y_4 Y_5 Z_0 Z_1 Z_3 + 0.0591692 Z_2 Z_3 - 0.00227945 X_1 Z_2 Z_3 + 0.000536879 X_4 Z_2 Z_3 - \\
& 0.0000256813 X_1 X_4 Z_2 Z_3 + 0.0000311764 Y_0 Y_1 Z_2 Z_3 - 0.000634314 X_4 Y_0 Y_1 Z_2 Z_3 - \\
& 0.0190046 Y_4 Y_5 Z_2 Z_3 + 0.000653789 X_1 Y_4 Y_5 Z_2 Z_3 + 0.00634842 Y_0 Y_1 Y_4 Y_5 Z_2 Z_3 + \\
& 0.0678392 Z_1 Z_2 Z_3 + 0.000638266 X_4 Z_1 Z_2 Z_3 - 0.0216777 Y_4 Y_5 Z_1 Z_2 Z_3 + 0.127086 Z_4 - \\
& 0.0561302 X_3 Z_4 - 2.04985 \times 10^{-6} X_0 X_3 Z_4 + 0.000159502 X_2 X_3 Z_4 + 0.000011104 X_1 X_2 X_3 Z_4 - \\
& 0.000447423 X_5 Z_4 + 0.00018075 X_0 X_5 Z_4 - 0.0000557449 X_0 X_1 X_5 Z_4 + 0.000252181 X_2 X_5 Z_4 + \\
& 0.0000557013 X_1 X_2 X_5 Z_4 + 0.0068963 X_3 X_5 Z_4 - 0.00115501 X_2 X_3 Y_0 Y_1 Z_4 + \\
& 4.65274 \times 10^{-6} X_2 X_5 Y_0 Y_1 Z_4 + 0.00115501 X_0 X_3 Y_1 Y_2 Z_4 - 4.65274 \times 10^{-6} X_0 X_5 Y_1 Y_2 Z_4 + \\
& 0.0000191089 Y_0 Y_3 Z_4 + 0.0000258501 Y_2 Y_3 Z_4 + 0.00012895 Y_0 Y_5 Z_4 + \\
& 0.000174441 Y_2 Y_5 Z_4 + 0.000587714 Y_3 Y_5 Z_4 + 0.0164168 X_3 Z_0 Z_4 + 0.000593752 X_1 X_3 Z_0 Z_4 + \\
& 0.000758441 X_5 Z_0 Z_4 - 0.0000274067 X_1 X_5 Z_0 Z_4 + 0.0000311241 X_3 Y_1 Y_2 Z_0 Z_4 + \\
& 0.0001908 X_5 Y_1 Y_2 Z_0 Z_4 - 0.0000200201 X_2 Y_1 Y_3 Z_0 Z_4 - 0.000135099 X_2 Y_1 Y_5 Z_0 Z_4 + \\
& 0.0000211588 X_0 X_3 Z_1 Z_4 - 0.000133652 X_2 X_3 Z_1 Z_4 - 0.0000517994 X_0 X_5 Z_1 Z_4 - \\
& 0.0000777401 X_2 X_5 Z_1 Z_4 + 0.0180857 X_3 Z_0 Z_1 Z_4 + 0.000726068 X_5 Z_0 Z_1 Z_4 + \\
& 0.0154095 X_3 Z_2 Z_4 - 0.000593557 X_1 X_3 Z_2 Z_4 + 0.000733397 X_5 Z_2 Z_4 + \\
& 0.0000287213 X_1 X_5 Z_2 Z_4 - 0.0000198838 X_3 Y_0 Y_1 Z_2 Z_4 - 0.00019084 X_5 Y_0 Y_1 Z_2 Z_4 + \\
& 0.0000200195 X_0 Y_1 Y_3 Z_2 Z_4 + 0.000135095 X_0 Y_1 Y_5 Z_2 Z_4 + 1.31465 \times 10^{-6} Y_1 Y_5 Z_0 Z_2 Z_4 + \\
& 0.0176676 X_3 Z_1 Z_2 Z_4 + 0.000692702 X_5 Z_1 Z_2 Z_4 - 0.277122 Z_3 Z_4 - 0.0000509732 X_0 Z_3 Z_4 - \\
& 0.0000311973 X_0 X_1 Z_3 Z_4 + 0.000554154 X_2 Z_3 Z_4 + 0.0000743536 X_1 X_2 Z_3 Z_4 - \\
& 0.00306375 X_5 Z_3 Z_4 - 0.0044347 X_2 Y_0 Y_1 Z_3 Z_4 + 0.0044347 X_0 Y_1 Y_2 Z_3 Z_4 + \\
& 0.0630377 Z_0 Z_3 Z_4 + 0.00227916 X_1 Z_0 Z_3 Z_4 + 0.0000743536 Y_1 Y_2 Z_0 Z_3 Z_4 + \\
& 0.0000509732 X_0 Z_1 Z_3 Z_4 - 0.000554154 X_2 Z_1 Z_3 Z_4 + 0.0694454 Z_0 Z_1 Z_3 Z_4 + \\
& 0.0591701 Z_2 Z_3 Z_4 - 0.00227916 X_1 Z_2 Z_3 Z_4 - 0.0000311973 Y_0 Y_1 Z_2 Z_3 Z_4 + \\
& 0.0678396 Z_1 Z_2 Z_3 Z_4 - 0.281932 Z_5 + 0.00175937 X_0 Z_5 - 0.00198685 X_0 X_1 Z_5 + \\
& 0.00307938 X_2 Z_5 + 0.00197102 X_1 X_2 Z_5 - 0.00147663 X_3 Z_5 + 0.00171463 X_4 Z_5 + \\
& 0.000634314 X_0 X_1 X_4 Z_5 - 4.8746 \times 10^{-6} X_2 X_4 Z_5 - 0.000634787 X_1 X_2 X_4 Z_5 + \\
& 0.00115327 X_3 X_4 Z_5 + 0.00163285 X_2 Y_0 Y_1 Z_5 + 0.0000466657 X_2 X_4 Y_0 Y_1 Z_5 - \\
& 0.00163285 X_0 Y_1 Y_2 Z_5 - 0.0000466657 X_0 X_4 Y_1 Y_2 Z_5 - 0.00628756 X_1 X_3 Y_0 Y_4 Z_5 - \\
& 0.0000611861 X_3 Y_1 Y_4 Z_5 + 0.00628775 X_1 X_3 Y_2 Y_4 Z_5 + 0.00165752 Y_3 Y_4 Z_5 + \\
& 1.45579 \times 10^{-6} X_0 Y_3 Y_4 Z_5 + 0.00628708 X_0 X_1 Y_3 Y_4 Z_5 - 5.63004 \times 10^{-6} X_2 Y_3 Y_4 Z_5 - \\
& 0.00628778 X_1 X_2 Y_3 Y_4 Z_5 + 0.0000532277 X_2 Y_0 Y_1 Y_3 Y_4 Z_5 - 0.0000532277 X_0 Y_1 Y_2 Y_3 Y_4 Z_5 + \\
& 0.0688291 Z_0 Z_5 - 0.00377663 X_1 Z_0 Z_5 - 0.00057444 X_4 Z_0 Z_5 - 0.0000256813 X_1 X_4 Z_0 Z_5 + \\
& 0.00197102 Y_1 Y_2 Z_0 Z_5 - 0.000768553 Y_3 Y_4 Z_0 Z_5 - 0.0000155702 X_1 Y_3 Y_4 Z_0 Z_5 - \\
& 0.00175937 X_0 Z_1 Z_5 - 0.00307938 X_2 Z_1 Z_5 + 0.000604774 X_0 X_4 Z_1 Z_5 + \\
& 0.000823784 X_2 X_4 Z_1 Z_5 - 0.00600159 X_3 Y_0 Y_4 Z_1 Z_5 - 0.00811879 X_3 Y_2 Y_4 Z_1 Z_5 + \\
& 0.00600013 X_0 Y_3 Y_4 Z_1 Z_5 + 0.00812442 X_2 Y_3 Y_4 Z_1 Z_5 + 0.0636474 Z_0 Z_1 Z_5 - \\
& 0.000643489 X_4 Z_0 Z_1 Z_5 - 0.00083422 Y_3 Y_4 Z_0 Z_1 Z_5 + 0.0670048 Z_2 Z_5 + \\
& 0.00377663 X_1 Z_2 Z_5 - 0.000536879 X_4 Z_2 Z_5 + 0.0000318528 X_1 X_4 Z_2 Z_5 -
\end{aligned}$$

$$\begin{aligned}
& 0.00198685 Y_0 Y_1 Z_2 Z_5 - 0.00072171 Y_3 Y_4 Z_2 Z_5 + 0.0000767563 X_1 Y_3 Y_4 Z_2 Z_5 + \\
& 0.0600449 Z_1 Z_2 Z_5 - 0.000638266 X_4 Z_1 Z_2 Z_5 - 0.000889543 Y_3 Y_4 Z_1 Z_2 Z_5 + 0.139703 Z_3 Z_5 - \\
& 0.000547046 X_4 Z_3 Z_5 + 0.0006342 X_1 Y_0 Y_4 Z_3 Z_5 + 6.17159 \times 10^{-6} Y_1 Y_4 Z_3 Z_5 - \\
& 0.000634219 X_1 Y_2 Y_4 Z_3 Z_5 + 0.000605355 Y_0 Y_4 Z_1 Z_3 Z_5 + 0.000818909 Y_2 Y_4 Z_1 Z_3 Z_5 - \\
& 0.288942 Z_4 Z_5 - 0.0000227489 X_0 Z_4 Z_5 - 0.00012608 X_0 X_1 Z_4 Z_5 + 0.000676671 X_2 Z_4 Z_5 + \\
& 0.000103924 X_1 X_2 Z_4 Z_5 + 0.00147663 X_3 Z_4 Z_5 + 0.00227721 X_2 Y_0 Y_1 Z_4 Z_5 - \\
& 0.00227721 X_0 Y_1 Y_2 Z_4 Z_5 + 0.0694442 Z_0 Z_4 Z_5 - 0.00443237 X_1 Z_0 Z_4 Z_5 + \\
& 0.000103924 Y_1 Y_2 Z_0 Z_4 Z_5 + 0.0000227489 X_0 Z_1 Z_4 Z_5 - 0.000676671 X_2 Z_1 Z_4 Z_5 + \\
& 0.0630389 Z_0 Z_1 Z_4 Z_5 + 0.0678368 Z_2 Z_4 Z_5 + 0.00443237 X_1 Z_2 Z_4 Z_5 - \\
& 0.00012608 Y_0 Y_1 Z_2 Z_4 Z_5 + 0.0591748 Z_1 Z_2 Z_4 Z_5 + 0.147366 Z_3 Z_4 Z_5
\end{aligned}$$

## RemoveIds

```

setTmpFile[".1 1 0 0 0 0 0"];
GetPauliString["tmp.txt"]
setTmpFile[".1 1 0 0 0 0 0"];
GetPauliString["tmp.txt", "RemoveIds" → False]

0.1 X0

0.1 Id1 Id2 Id3 Id4 Id5 X0

```

## numQubits

```

setTmpFile[".1 1 0 0"];
GetPauliString["tmp.txt", 10]

setTmpFile[".1 1 0 0"];
GetPauliString["tmp.txt", 10, "RemoveIds" → True]

0.1 Id1 Id2 Id3 Id4 Id5 Id6 Id7 Id8 Id9 X0

0.1 X0

GetPauliString["https://qtechtheory.org/hamil_6qbLiH.txt", 20][[;; 10]]
-6.52209 Id0 Id1 Id2 Id3 Id4 Id5 Id6 Id7 Id8 Id9 Id10 Id11
  Id12 Id13 Id14 Id15 Id16 Id17 Id18 Id19 - 0.00168947 Id1 Id2 Id3 Id4
  Id5 Id6 Id7 Id8 Id9 Id10 Id11 Id12 Id13 Id14 Id15 Id16 Id17 Id18 Id19 X0 +
0.000335609 Id0 Id2 Id3 Id4 Id5 Id6 Id7 Id8 Id9 Id10 Id11 Id12 Id13 Id14 Id15
  Id16 Id17 Id18 Id19 X1 + 0.00233908 Id2 Id3 Id4 Id5 Id6 Id7 Id8 Id9 Id10
  Id11 Id12 Id13 Id14 Id15 Id16 Id17 Id18 Id19 X0 X1 - 0.00518865 Id0 Id1 Id3
  Id4 Id5 Id6 Id7 Id8 Id9 Id10 Id11 Id12 Id13 Id14 Id15 Id16 Id17 Id18 Id19 X2 -
2.32678 × 10-6 Id1 Id3 Id4 Id5 Id6 Id7 Id8 Id9 Id10 Id11 Id12 Id13 Id14
  Id15 Id16 Id17 Id18 Id19 X0 X2 - 0.00238276 Id0 Id3 Id4 Id5 Id6
  Id7 Id8 Id9 Id10 Id11 Id12 Id13 Id14 Id15 Id16 Id17 Id18 Id19 X1 X2 -
0.000333484 Id3 Id4 Id5 Id6 Id7 Id8 Id9 Id10 Id11 Id12 Id13 Id14 Id15 Id16
  Id17 Id18 Id19 X0 X1 X2 + 0.0561302 Id0 Id1 Id2 Id4 Id5 Id6 Id7 Id8 Id9 Id10
  Id11 Id12 Id13 Id14 Id15 Id16 Id17 Id18 Id19 X3 + 0.0000211588 Id1 Id2 Id4
  Id5 Id6 Id7 Id8 Id9 Id10 Id11 Id12 Id13 Id14 Id15 Id16 Id17 Id18 Id19 X0 X3

```

## targets

```

setTmpFile["3 1 2 3"];
GetPauliString["tmp.txt", {5, 6, 7}]

 $3 X_5 Y_6 Z_7$ 

setTmpFile["3 1 2 3\n3 3 2 1"];
GetPauliString["tmp.txt", {5, 6, 7}]

 $3 X_7 Y_6 Z_5 + 3 X_5 Y_6 Z_7$ 

GetPauliString[
  "https://qtechtheory.org/hamil_6qbLiH.txt", {9, 8, 7, 6, 5, 4}][[;; 10]]
- 6.52209 Id9 + 0.000447423 X4 + 0.000547046 X5 +
  0.0661688 X4 X5 + 0.0561302 X6 - 0.00630859 X4 X6 + 0.00165752 X5 X6 +
  0.00562722 X4 X5 X6 - 0.00518865 X7 - 0.0000777401 X4 X7

```

## Errors

---

### Matrix

```

GetPauliString @ {{1, 2, 3}}
GetPauliString @ IdentityMatrix[6]

... GetPauliString: Matrix must be square with a power-of-2 number of rows and columns.
$Failed

... GetPauliString: Matrix must be square with a power-of-2 number of rows and columns.
$Failed

m = RandomInteger[{-10, 10}, {2^3, 2^3}];
GetPauliString[m, 2]

... GetPauliString: The specified number of qubits (2) was fewer than that suggested (3) by the matrix's dimension.
$Failed

m = RandomInteger[{-10, 10}, {4, 4}];
GetPauliString[m, {0}]

... GetPauliString: A different number of target qubits was given (1) than exists in the Pauli string (2).
$Failed

```

```
m = RandomInteger[{-10, 10}, {4, 4}];
GetPauliString[m, {}]
GetPauliString[m, 2, {}]
GetPauliString[m, {}, 2]
```

... **GetPauliString**: Optional list of target qubits must not be empty.

\$Failed

... **GetPauliString**: Optional list of target qubits must not be empty.

\$Failed

... **GetPauliString**: Optional list of target qubits must not be empty.

\$Failed

```
m = RandomInteger[{-10, 10}, {4, 4}];
GetPauliString[m, 4, {1, 2, 3}]
```

... **GetPauliString**: A different number of target qubits was given (3) than exists in the Pauli string (4).

\$Failed

```
GetPauliString[m, "BadOption" → True]
```

... **OptionValue**: Unknown option BadOption for GetPauliString.

$$\begin{aligned}
& -\frac{13}{4} \text{Id}_1 + \frac{19}{4} X_0 + \frac{23}{4} X_1 - X_0 X_1 - \frac{5}{4} i Y_0 - \frac{11}{2} i X_1 Y_0 + \frac{7}{4} i Y_1 + \frac{1}{2} i X_0 Y_1 - \\
& 3 Y_0 Y_1 - \frac{9}{4} Z_0 - \frac{11}{4} X_1 Z_0 + \frac{5}{4} i Y_1 Z_0 + \frac{Z_1}{4} + \frac{3 X_0 Z_1}{4} + \frac{3}{4} i Y_0 Z_1 + \frac{Z_0 Z_1}{4}
\end{aligned}$$

## Index

```
GetPauliString[-1]
```

... **GetPauliString**: Index must be positive or zero.

\$Failed

```
GetPauliString[1, 0]
```

... **GetPauliString**: Invalid arguments. See ?GetPauliString

\$Failed

```
GetPauliString[123, 2]
```

... **GetPauliString**: The given index (123) exceeds the maximum possible ( $15 = 4^{2-1}$ ) for the given number of Pauli operators (2).

\$Failed

```
GetPauliString[123, {2, 4}]
```

... **GetPauliString**: A different number of target qubits was given (2) than exists in the Pauli string (4).

\$Failed

```
GetPauliString[123, blah]
```

... **GetPauliString**: Invalid arguments. See ?GetPauliString

```
$Failed
```

```
GetPauliString[3, 1, "BadOption" → True]
```

... **OptionValue**: Unknown option BadOption for GetPauliString.

```
Z0
```

## Digits

```
GetPauliString[{1, 0, 0}, {1, 2, 3, 4}]
```

... **GetPauliString**: A different number of target qubits was given (4) than exists in the Pauli string (3).

```
$Failed
```

```
GetPauliString[{4, 0, 0}]
```

```
GetPauliString[{-1, 0, 0}]
```

... **GetPauliString**: Each individual digit must be one of 0 (denoting Id), 1 (X), 2 (Y) or 3 (Z).

```
$Failed
```

... **GetPauliString**: Each individual digit must be one of 0 (denoting Id), 1 (X), 2 (Y) or 3 (Z).

```
$Failed
```

```
GetPauliString[{a, b, c}]
```

... **GetPauliString**: Invalid arguments. See ?GetPauliString

```
$Failed
```

```
GetPauliString[{0, 0, 0}, 2]
```

... **GetPauliString**: The overridden number of qubits was fewer than the number of given digits.

```
$Failed
```

```
GetPauliString[{0, 0, 0}, 0]
```

... **GetPauliString**: Invalid arguments. See ?GetPauliString

```
$Failed
```

## Address

```
setTmpFile["eh"];
```

```
GetPauliString["tmp.txt"]
```

... **GetPauliString**: Parsing the file failed due to the below error:

... **ReadList**: Invalid real number found when reading from tmp.txt.

```
$Failed
```

```
setTmpFile[".1 1 0 0 0 0 0"];
GetPauliString["tmp.txt", 4]
```

... **GetPauliString**: The specified number of qubits (4) was fewer than that encoded in the file (6).

\$Failed

```
GetPauliString["https://qtechtheory.org/hamil_6qbLiH.txt", {9, 8, 7, 5, 4}]
```

... **GetPauliString**: A different number of target qubits was given (5) than exists in the Pauli string (6).

\$Failed

```
GetPauliString["https://qtechtheory.org/hamil_6qbLiH.txt", {9, 9, 9, 9, 9, 9}]
GetPauliString["https://qtechtheory.org/hamil_6qbLiH.txt",
  {-1, -2, -3, -4, -5, -6}]
```

... **GetPauliString**: The list of target qubits must be non-negative and unique.

\$Failed

... **GetPauliString**: The list of target qubits must be non-negative and unique.

\$Failed

```
GetPauliString["https://qtechtheory.org/hamil_6qbLiH.txt", -1]
```

... **GetPauliString**: Invalid arguments. See ?GetPauliString

\$Failed

```
GetPauliString[
  "https://qtechtheory.org/hamil_6qbLiH.txt", "BadOption" → True][[;; 5]]
```

... **OptionValue**: Unknown option BadOption for GetPauliString.

$-6.52209 \text{ Id}_0 - 0.00168947 X_0 + 0.000335609 X_1 + 0.00233908 X_0 X_1 - 0.00518865 X_2$