

## SYNOPSIS

```
use Fingerprints::FingerprintsStringUtil qw(:all);
```

## DESCRIPTION

AreFingerprintsStringValuesValid, GenerateFingerprintsBitVectorString, GenerateFingerprintsString, GenerateFingerprintsVectorString, GetDefaultBitStringFormat, GetDefaultBitsOrder, GetDefaultVectorStringFormat, GetFingerprintsStringDelimiter, GetFingerprintsStringTypeAndDescription, GetFingerprintsStringValues, ParseFingerprintsBitVectorString, ParseFingerprintsString, ParseFingerprintsVectorString

```
FingerprintsVector;AtomNeighborhoods:AtomicInvariantsAtomTypes:MinRadi
us0:MaxRadius2;41;AlphaNumericalValues;ValuesString;NR0-C.X1.BO1.H3-AT
C1:NR1-C.X3.BO3.H1-ATC1:NR2-C.X1.BO1.H3-ATC1:NR2-C.X3.BO4-ATC1 NR0-C.X
1.BO1.H3-ATC1:NR1-C.X3.BO3.H1-ATC1:NR2-C.X1.BO1.H3-ATC1:NR2-C.X3.BO4-A
TC1 NR0-C.X2.BO2.H2-ATC1:NR1-C.X2.BO2.H2-ATC1:NR1-C.X3.BO3.H1-ATC1:NR2
-C.X2.BO2.H2-ATC1:NR2-N.X3.BO3-ATC1:NR2-O.X1.BO1.H1-ATC1 NR0-C.X2.B
```

```
FingerprintsVector;AtomTypesCount:AtomicInvariantsAtomTypes:ArbitraryS
size;10;NumericalValues;IDsAndValuesString;C.X1.BO1.H3 C.X2.BO2.H2 C.X2
.BO3.H1 C.X3.BO3.H1 C.X3.BO4 F.X1.BO1 N.X2.BO2.H1 N.X3.BO3 O.X1.BO1.H1
O.X1.BO2;2 4 14 3 10 1 1 1 3 2
```

```
FingerprintsVector;AtomTypesCount:SLogPAtomTypes:ArbitrarySize;16;Num  
ericalValues;IDsAndValuesString;C1 C10 C11 C14 C18 C20 C21 C22 C5 CS F  
N11 N4 O10 O2 O9;5 1 1 1 14 4 2 1 2 2 1 1 1 1 3 1
```

[illegible]

```
FingerprintsVector;EStateIndicies:ArbitrarySize;11;NumericalValues;IDS
AndValuesString;SaaCH SaasC SaasN SdO SdssC SsCH3 SsF SsOH SssCH2 SssN
H SsssCH;24.778 4.387 1.993 25.023 -1.435 3.975 14.006 29.759 -0.073 3
.024 -2.270
```

```
FingerprintsVector;EStateIndicies:FixedSize;87;OrderedNumericalValues;
ValuesString;0 0 0 0 0 0 0 3.975 0 -0.073 0 0 24.778 -2.270 0 0 -1.435
4.387 0 0 0 0 0 0 3.024 0 0 0 0 0 0 0 1.993 0 29.759 25.023 0 0 0 0 1
4.006 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

```
FingerprintsVector;ExtendedConnectivity:AtomicInvariantsAtomTypes:Radi
us2;60;AlphaNumericalValues;ValuesString;73555770 333564680 352413391
666191900 1001270906 1371674323 1481469939 1977749791 2006158649 21414
08799 49532520 64643108 79385615 96062769 273726379 564565671 85514103
5 906706094 988546669 1019231313 1032696425 1193507444 1331250018 1338
532734 1455473691 1607485225 1609687129 1631614296 1670251330 17303...
```

```
FingerprintsVector;ExtendedConnectivityCount:AtomicInvariantsAtomTypes
:Radius2;60;NumericalValues;IDsAndValuesString;73555770 333564680 3524
13391 666191900 1001270906 1371674323 1481469939 1977749791 2006158649
2141408799 49532520 64643108 79385615 96062769 273726379 564565671...;
3 2 1 1 14 1 2 10 4 3 1 1 1 1 2 1 1 1 2 3 1 2 1 3 3 8 2 2 6 2
1 2 1 1 2 1 1 2 1 1 2 1 1 1 1 1 1 1 1 1 1 2 1 1
```

```
FingerprintsBitVector;ExtendedConnectivityBits:AtomicInvariantsAtomType  
es:Radius2;1024;BinaryString;Ascending;0000000000000000000000000000100  
000000000101000000011000001100000000000010000000000000000000000100001  
100000011000000000000000000000000000010011000000000000000000000010000  
0000000000000000000000000000000000000000000000000000000000000000000  
0000000000001000010000100000000000010100000000000000100000000000000000...  

```

```
FingerprintsVector;ExtendedConnectivity:FunctionalClassAtomTypes:Radiu
s2;57;AlphaNumericalValues;ValuesString;24769214 508787397 850393286 8
62102353 981185303 1231636850 1649386610 1941540674 263599683 32920567
1 571109041 639579325 683993318 723853089 810600886 885767127 90326012
7 958441485 981022393 1126908698 1152248391 1317567065 1421489994 1455
632544 1557272891 1826413669 1983319256 2015750777 2029559552 20404...
```

```
FingerprintsVector;ExtendedConnectivity:EStateAtomTypes:Radius2;62;Alp
haNumericalValues;ValuesString;25189973 528584866 662581668 671034184
926543080 1347067490 1738510057 1759600920 2034425745 2097234755 21450
44754 96779665 180364292 341712110 345278822 386540408 387387308 50430
1706 617094165 717528807 967666640 997798220 1158349170 1291258082 134
1138533 1395329837 1420277211 1479584608 1486476397 1487556246 1566...
```

```
FingerprintsBitVector;MACCSKeyBits;166;BinaryString;Ascending;00000000
000000000000000000000000000000001001000010010000000010010000000011100
01001010101111000110110001001101100000110111101001101111111111101111
11111111111110111000
```

[illegible][illegible]

```
FingerprintsVector;MACCSKeyCount;322;OrderedNumericalValues;ValuesString;14 8 2 0 2 0 4 4 2 1 4 0 0 2 5 10 5 2 1 0 0 2 0 5 13 3 28 5 5 3 0 0  
0 4 2 1 1 0 1 1 0 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 22 5 3 0 0 0 1 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 11 0 2 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 ...
```

```
FingerprintsBitVector;PathLengthBits:AtomicInvariantsAtomTypes:MinLength:MaxLength8;1024;BinaryString;Ascending;001000010011010101011000110010001010101100010100101110011000100001000100110100000100100100100100001010110010010000011001001000001001010100100100000000011000000101001011100010010000001001010100000100110100000100111100110110110110110110110110000001011011100110101011000110001000011000100001100011010000100001000100000000... 
```

```
FingerprintsVector;PathLengthCount:AtomicInvariantsAtomTypes:MinLength
1:MaxLength8;432;NumericalValues;IDsAndValuesPairsString;C.X1.B01.H3
2 C.X2.B02.H2 4 C.X2.B03.H1 14 C.X3.B03.H1 3 C.X3.B04 10 F.X1.B01 1 N.X
2.B02.H1 1 N.X3.B03 1 O.X1.B01.H1 3 O.X1.B02 2 C.X1.B01.H3C.X3.B03.H1
2 C.X2.B02.H2C.X2.B02.H2 1 C.X2.B02.H2C.X3.B03.H1 4 C.X2.B02.H2C.X3.B0
4 1 C.X2.B02.H2N.X3.B03 1 C.X2.B03.H1C.X2.B03.H1 10 C.X2.B03.H1C.X...
```

```
FingerprintsVector;PathLengthCount;MMFF94AtomTypes;MinLength1:MaxLength1:
h8;463;NumericalValues;IDsAndValuesPairsString;C5A 2 C5B 2 C=ON 1 CB 1
8 COO 1 CR 9 F 1 N5 1 NC=O 1 O=CN 1 O=CO 1 OC=O 1 OR 2 C5A:C5B 2 C5A:N
5 2 C5ACB 1 C5ACR 1 C5B:C5B 1 C5BC=ON 1 C5BCB 1 C=ON=O=CN 1 C=ONNC=O 1
```

```
CB:CB 18 CBF 1 CBNC=O 1 COO=O=CO 1 COOCR 1 COOOC=O 1 CRCR 7 CRN5 1 CR
OR 2 C5A:C5B:C5B 2 C5A:C5BC=ON 1 C5A:C5BCB 1 C5A:N5:C5A 1 C5A:N5CR ...
```

```
FingerprintsVector;TopologicalAtomPairs:AtomicInvariantsAtomTypes:MinDi
stancel:MaxDistance10;223;NumericalValues;IDsAndValuesString;C.X1.B01
.H3-D1-C.X3.B03.H1 C.X2.B02.H2-D1-C.X2.B02.H2 C.X2.B02.H2-D1-C.X3.B03.
H1 C.X2.B02.H2-D1-C.X3.B04 C.X2.B02.H2-D1-N.X3.B03 C.X2.B03.H1-D1-...;
2 1 4 1 1 10 8 1 2 6 1 2 2 1 2 2 1 2 2 1 2 1 5 1 10 12 2 2 1 2 1 9 1 3 1
1 1 2 2 1 3 6 1 6 14 2 2 2 3 1 3 1 8 2 2 1 3 2 6 1 2 2 5 1 3 1 23 1...
```

```
FingerprintsVector;TopologicalAtomPairs:FunctionalClassAtomTypes:MinDi
stancel:MaxDistance10;144;NumericalValues;IDsAndValuesString;Ar-D1-Ar
Ar-D1-Ar.HBA Ar-D1-HBD Ar-D1-Hal Ar-D1-None Ar.HBA-D1-None HBA-D1-NI H
BA-D1-None HBA.HBD-D1-NI HBA.HBD-D1-None HBD-D1-None NI-D1-None No...;
23 2 1 1 2 1 1 1 2 1 1 7 28 3 1 3 2 8 2 1 1 1 5 1 5 24 3 3 4 2 13 4
1 1 4 1 5 22 4 4 3 1 19 1 1 1 1 1 2 2 3 1 1 8 25 4 5 2 3 1 26 1 4 1 ...
```

```
FingerprintsVector;TopologicalAtomTorsions:AtomicInvariantsAtomTypes;3
3;NumericalValues;IDsAndValuesString;C.X1.B01.H3-C.X3.B03.H1-C.X3.B04-
C.X3.B04 C.X1.B01.H3-C.X3.B03.H1-C.X3.B04-N.X3.B03 C.X2.B02.H2-C.X2.B0
2.H2-C.X3.B03.H1-C.X2.B02.H2 C.X2.B02.H2-C.X2.B02.H2-C.X3.B03.H1-O...;
2 2 1 1 2 2 1 1 3 4 4 8 4 2 2 6 2 2 1 2 1 1 2 1 1 2 6 2 4 2 1 3 1
```

```
FingerprintsVector;TopologicalAtomTorsions:EStateAtomTypes;36;Numerica
lValues;IDsAndValuesString;aaCH-aaCH-aaCH-aaCH aaCH-aaCH-aaCH-aasC aaC
H-aaCH-aasC-aaCH aaCH-aaCH-aasC-aasC aaCH-aaCH-aasC-sF aaCH-aaCH-aasC-
ssNH aaCH-aasC-aasC-aasC aaCH-aasC-aasC-aasN aaCH-aasC-ssNH-dssC a...;
4 4 8 4 2 2 6 2 2 2 4 3 2 1 3 3 2 2 2 1 2 1 1 1 2 1 1 1 1 1 1 1 2 1 1 2
```

```
FingerprintsVector;TopologicalAtomTriplets:AtomicInvariantsAtomTypes:M
inDistance1:MaxDistance10;3096;NumericalValues;IDsAndValuesString;C.X1
.B01.H3-D1-C.X1.B01.H3-D1-C.X3.B03.H1-D2 C.X1.B01.H3-D1-C.X2.B02.H2-D1
0-C.X3.B04-D9 C.X1.B01.H3-D1-C.X2.B02.H2-D3-N.X3.B03-D4 C.X1.B01.H3-D1
-C.X2.B02.H2-D4-C.X2.B02.H2-D5 C.X1.B01.H3-D1-C.X2.B02.H2-D6-C.X3...;
1 2 2 2 2 2 2 8 8 4 8 4 4 2 2 2 4 2 2 2 4 2 2 2 2 1 2 2 4 4 4 2 2
2 4 4 4 8 4 4 2 4 4 4 2 4 4 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 8...
```

```
FingerprintsVector;TopologicalAtomTriplets:SYBYLAtomTypes:MinDistancel
:MaxDistance10;2332;NumericalValues;IDsAndValuesString;C.2-D1-C.2-D9-C
.3-D10 C.2-D1-C.2-D9-C.ar-D10 C.2-D1-C.3-D1-C.3-D2 C.2-D1-C.3-D10-C.3-
D9 C.2-D1-C.3-D2-C.3-D3 C.2-D1-C.3-D2-C.ar-D3 C.2-D1-C.3-D3-C.3-D4 C.2
-D1-C.3-D3-N.ar-D4 C.2-D1-C.3-D3-O.3-D2 C.2-D1-C.3-D4-C.3-D5 C.2-D1-C.
3-D5-C.3-D6 C.2-D1-C.3-D5-O.3-D4 C.2-D1-C.3-D6-C.3-D7 C.2-D1-C.3-D7...
```

```
FingerprintsVector;TopologicalPharmacophoreAtomPairs:ArbitrarySize:MinDi
stancel:MaxDistance10;54;NumericalValues;IDsAndValuesString;H-D1-H H
-D1-NI HBA-D1-NI HBD-D1-NI H-D2-H H-D2-HBA H-D2-HBD HBA-D2-HBA HBA-D2-
HBD H-D3-H H-D3-HBA H-D3-HBD H-D3-NI HBA-D3-NI HBD-D3-NI H-D4-H H-D4-H
BA H-D4-HBD HBA-D4-HBA HBA-D4-HBD HBD-D4-HBD H-D5-H H-D5-HBA H-D5-...;
18 1 2 1 22 12 8 1 2 18 6 3 1 1 1 22 13 6 5 7 2 28 9 5 1 1 1 36 16 10
3 4 1 37 10 8 1 35 10 9 3 3 1 28 7 7 4 18 16 12 5 1 2 1
```

```
FingerprintsVector;TopologicalPharmacophoreAtomPairs:FixedSize:MinDist
ancel:MaxDistance10;150;OrderedNumericalValues;ValuesString;18 0 0 1 0
0 0 2 0 0 1 0 0 0 0 22 12 8 0 0 1 2 0 0 0 0 0 0 0 0 18 6 3 1 0 0 0 1
0 0 1 0 0 0 0 22 13 6 0 0 5 7 0 0 2 0 0 0 0 0 0 28 9 5 1 0 0 0 1 0 0 1 0
0 0 0 36 16 10 0 0 3 4 0 0 1 0 0 0 0 0 37 10 8 0 0 0 0 1 0 0 0 0 0 0
0 35 10 9 0 0 3 3 0 0 1 0 0 0 0 0 28 7 7 4 0 0 0 0 0 0 0 0 0 0 0 0 18...
```

```
FingerprintsVector;TopologicalPharmacophoreAtomTriplets:ArbitrarySize:
MinDistance1:MaxDistance10;696;NumericalValues;IDsAndValuesString;Ar1-
Ar1-Ar1 Ar1-Ar1-H1 Ar1-Ar1-HBA1 Ar1-Ar1-HBD1 Ar1-H1-H1 Ar1-H1-HBA1 Ar1
-H1-HBD1 Ar1-HBA1-HBD1 H1-H1-H1 H1-H1-HBA1 H1-H1-HBD1 H1-HBA1-HBA1 H1-
HBA1-HBD1 H1-HBA1-NI1 H1-HBD1-NI1 HBA1-HBA1-NI1 HBA1-HBD1-NI1 Ar1-...;
46 106 8 3 83 11 4 1 21 5 3 1 2 2 1 1 1 100 101 18 11 145 132 26 14 23
```

```
28 3 3 5 4 61 45 10 4 16 20 7 5 1 3 4 5 3 1 1 1 5 4 2 1 2 2 1 1 1
119 123 24 15 185 202 41 25 22 17 3 5 85 95 18 11 23 17 3 1 1 6 4 ...
```

```
FingerprintsVector;TopologicalPharmacophoreAtomTriplets:FixedSize:MinD
istance1:MaxDistance10;2692;OrderedNumericalValues;ValuesString;46 106
8 3 0 0 83 11 4 0 0 0 1 0 0 0 0 0 0 0 0 21 5 3 0 0 1 2 2 0 0 1 0 0 0
0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 100 101 18 11 0 0 145 132 26
14 0 0 23 28 3 3 0 0 5 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 61 45 10 4 0
0 16 20 7 5 1 0 3 4 5 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 5 ...
```

## FUNCTIONS

### AreFingerprintsStringValuesValid

```
$Status = AreFingerprintsStringValuesValid($FPString);
```

Returns 0 or 1 based on whether *FingerprintsString* contains valid values.

### GetDefaultBitStringFormat

```
$BitStringFormat = GetDefaultBitStringFormat();
```

Returns default BitStringFormat for fingerprints bit-vector strings.

### GetDefaultBitsOrder

```
$BitsOrder = GetDefaultBitsOrder();
```

Returns default BitsOrder for fingerprints bit-vector fingerprints.

### GetDefaultVectorStringFormat

```
$StringFormat = GetDefaultVectorStringFormat();
```

Returns default VectorStringFormat for fingerprints vector strings.

### GetFingerprintsStringDelimiter

```
$Delimiter = GetFingerprintsStringDelimiter();
```

Returns string Delimiter used to generate fingerprints bit-vector and vector strings.

### GenerateFingerprintsBitVectorString

```
$FPString = GenerateFingerprintsBitVectorString($FPBitVectorObject,
[$BitStringFormat, $BitsOrder]);
```

Returns a FingerprintsString generated using *FingerprintsBitVectorObject* and optionally specified *BitStringFormat* and *BitsOrder* values.

Possible *BitStringFormat* values: *BinaryString*, *Binary*, *Bin*, *HexadecimalString*, *Hexadecimal*, or *Hex*. Default *BitStringFormat* value: *BinaryString*.

Possible *BitsOrder* values: *Ascending* or *Descending*. Default *BitsOrder* value: *Ascending*.

### GenerateFingerprintsVectorString

```
$FPString = GenerateFingerprintsVectorString($FPVectorObject,
[$VectorStringFormat]);
```

Returns a FingerprintsString generated using *FingerprintsVectorObject* and optionally specified *VectorStringFormat*.

Possible *VectorStringFormat* values: *IDsAndValuesString*, *IDsAndValues*, *IDsAndValuesPairsString*, *IDsAndValuesPairs*, *ValuesAndIDsString*, *ValuesAndIDs*, *ValuesAndIDsPairsString*, *ValuesAndIDsPairs*, *ValuesString*, *Values*.

Default *VectorStringFormat* value: for *NumericalValues FPVectorType* - *IDsAndValuesString*; for all other *FPVectorTypes* - *ValuesString*.

### GenerateFingerprintsString

```
$FPString = GenerateFingerprintsBitVectorString($FPBitVectorObject,
[$BitStringFormat, $BitsOrder]);
```

```
$FPString = GenerateFingerprintsVectorString($FPVectorObject,
[$VectorStringFormat]);
```

Returns a FingerprintsString generated using *FingerprintsBitVectorObject* or *FingerprintsVectorObject* and optionally specified parameters.

#### GetFingerprintsStringTypeAndDescription

```
( $FPType, $FPDescription ) = GetFingerprintsStringTypeAndDescription(
    $FPString );
```

Returns FingerprintsStringType and *FingerprintsStringDescription* strings for FingerprintsString corresponding to FingerprintsBitVectorObject or FingerprintsVectorObject.

#### GetFingerprintsStringValues

```
@FPStringValues = GetFingerprintsStringValues($FPString);
```

Parses FingerprintsString corresponding to FingerprintsBitVectorObject or FingerprintsVectorObject and returns its individual component values as an array.

#### ParseFingerprintsBitVectorString

```
$FPBitVectorObject = ParseFingerprintsBitVectorString($FPBitVectorString,
    [$ValidateValues]);
```

Returns FingerprintsBitVectorObject generated by parsing *FingerprintsBitVectorString* with optional validation of its component values.

#### ParseFingerprintsString

```
$FPBitVectorObject = ParseFingerprintsBitVectorString($FPBitVectorString,
    [$ValidateValues]);
```

```
$FPVectorObject = ParseFingerprintsVectorString($FPVectorString,
    [$ValidateValues]);
```

Returns FingerprintsBitVectorObject or ***FingerprintsVectorObject*** generated by parsing *FingerprintsBitVectorString* or *FingerprintsVectorString* with optional validation of its component values.

#### ParseFingerprintsVectorString

```
$FPVectorObject = ParseFingerprintsVectorString($FPVectorString,
    [$ValidateValues]);
```

Returns FingerprintsVectorObject generated by parsing *FingerprintsVectorString* with optional validation of its component values.

#### AUTHOR

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#### SEE ALSO

BitVector.pm, FingerprintsBitVector.pm, FingerprintsVector.pm, Vector.pm

#### COPYRIGHT

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