The l3bitset package
Experimental bitsets

The LaTeX Project*

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This package defines and implements the data type `bitset`, a vector of bits. The size of the vector may grow dynamically. Individual bits can be set and unset by names pointing to an index position. The names `1`, `2`, `3`, ... are predeclared and point to the index positions 1, 2, 3,.... More names can be added and existing names can be changed. The index is like all other indices in expl3 modules *1-based*. A `bitset` can be output as binary number or—as needed e.g. in a PDF dictionary—as decimal (arabic) number. Currently only a small subset of the functions provided by the bitset package are implemented here, mainly the functions needed to use bitsets in PDF dictionaries.

The bitset is stored as a string (but one shouldn't rely on the internal representation) and so the vector size is theoretically unlimited, only restricted by TeX-memory. But the functions to set and clear bits uses integer functions for the index so bitsets can't be longer than $2^{31} - 1$. The export function `\bitset_to_arabic:N` can use functions from the `int` module only if the largest index used for this bitset is smaller then 32, for longer bitsets `fp` is used and this is slower.

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1 Creating bitsets

\bitset_new:N
\bitset_new:c
\bitset_new:Nn
\bitset_new:cn

New: 2021-01-26
Updated: 2020-12-29

\bitset_new:N ⟨*bitset var*⟩
\bitset_new:Nn ⟨*bitset var*⟩
{
⟨*name1*⟩ = ⟨*index1*⟩ ,
⟨*name2*⟩ = ⟨*index2*⟩ , ...
}

Creates a new ⟨*bitset var*⟩ or raises an error if the name is already taken. The declaration is global. The ⟨*bitset var*⟩ is initially 0.

Bitsets are implemented as string variables consisting of `1`'s and `0`'s. The rightmost number is the index position 1, so the string variable can be viewed directly as the binary number. But one shouldn't rely on the internal representation, but use the dedicated `\bitset_to_bin:N` instead to get the binary number.

The name–index pairs given in the second argument of `\bitset_new:Nn` declares names for some indices, which can be used to set and unset bits. The names `1`, `2`, `3`, ... are predeclared and point to the index positions 1, 2, 3, ...

⟨*index...*⟩ should be a positive number or an ⟨*integer expression*⟩ which evaluates to a positive number. The expression is evaluated when the index is used, not a declaration time. The names ⟨*name...*⟩ should be unique. Using a number as name, e.g. `10=1`, is allowed, it then overwrites the predeclared name `10`, but the index position 10 can then only be reached if some other name for it exists, e.g. `ten=10`. It is not necessary to give every index a name, and an index can have more than one name. The named index can be extended or changed with the next function.

\bitset_addto_named_index:Nn

New: 2021-01-26

```
\bitset_addto_named_index:Nn ⟨bitset var⟩
{
⟨name1⟩ = ⟨index1⟩ ,
⟨name2⟩ = ⟨index2⟩ , ...
}
```

This extends or changes the name–index pairs for ⟨*bitset var*⟩ globally as described for \bitset_new:Nn.

For example after these settings

```
\bitset_new:Nn \l_pdfannot_F_bitset
  {
    Invisible      = 1,
    Hidden         = 2,
    Print          = 3,
    NoZoom         = 4,
    NoRotate       = 5,
    NoView         = 6,
    ReadOnly       = 7,
    Locked         = 8,
    ToggleNoView   = 9,
    LockedContents = 10
  }
\bitset_addto_named_index:Nn \l_pdfannot_F_bitset
  {
    print = 3
  }
```

it is possible to set bit 3 by using any of this alternatives:

```
\bitset_set_true:Nn \l_pdfannot_F_bitset {Print}
\bitset_set_true:Nn \l_pdfannot_F_bitset {print}
\bitset_set_true:Nn \l_pdfannot_F_bitset {3}
```

\bitset_if_exist_p:N ⋆
\bitset_if_exist_p:c ⋆
\bitset_if_exist:NTF ⋆
\bitset_if_exist:cTF ⋆

New: 2021-01-26

```
\bitset_if_exist_p:N ⟨bitset var⟩
\bitset_if_exist:NTF ⟨bitset var⟩ {⟨true code⟩} {⟨false code⟩}
```

Tests whether the ⟨*bitset var*⟩ exist.

2 Setting and unsetting bits

\bitset_set_true:Nn
\bitset_set_true:cn
\bitset_gset_true:Nn
\bitset_gset_true:cn

New: 2021-01-26

```
\bitset_set_true:Nn   ⟨bitset var⟩  {⟨name⟩}
\bitset_gset_true:Nn  ⟨bitset var⟩  {⟨name⟩}
```

This sets the bit of the index position represented by {⟨*name*⟩} to 1. {⟨*name*⟩} should be either one of the predeclared names 1, 2, 3, ..., or one of the names added manually. Index position are 1-based. If needed the length of the bit vector is enlarged.

\bitset_set_false:Nn
\bitset_set_false:(cn|cn)
\bitset_gset_false:Nn

New: 2021-01-26

\bitset_set_false:Nn ⟨*bitset var*⟩ {⟨*name*⟩}
\bitset_gset_false:Nn ⟨*bitset var*⟩ {⟨*name*⟩}

This unsets the bit of the index position represented by {⟨*name*⟩} (sets it to 0). {⟨*name*⟩} should be either one of the predeclared names 1, 2, 3, ..., or one of the names added manually. The index is 1-based. If the index position is larger than the current length of the bit vector nothing happens. If the leading (left most) bit is unset, zeros are not trimmed but stay in the bit vector and are still shown by \bitset_show:N.

\bitset_clear:N
\bitset_clear:c
\bitset_gclear:N
\bitset_gclear:c

New: 2021-01-26

\bitset_clear:N ⟨*bitset var*⟩
\bitset_gclear:N ⟨*bitset var*⟩

This resets the bitset to the initial state. The declared names are not changed.

3 Using bitsets

\bitset_item:Nn ⋆
\bitset_item:cn ⋆

New: 2021-01-26

\bitset_item:Nn ⟨*bitset var*⟩ {⟨*name*⟩}

\bitset_item:Nn outputs 1 if the bit with the index number represented by {⟨*name*⟩} is set and 0 otherwise. {⟨*name*⟩} is either one of the predeclared names 1, 2, 3, ..., or one of the names added manually.

\bitset_to_bin:N ⋆
\bitset_to_bin:c ⋆

New: 2021-01-26

\bitset_to_bin:N ⟨*bitset var*⟩

This leaves the current value of the bitset expressed as a binary (string) number in the input stream. If no bit has been set yet, the output is zero.

\bitset_to_arabic:N ⋆
\bitset_to_arabic:c ⋆

New: 2021-01-26

\bitset_to_arabic:N ⟨*bitset var*⟩

This leaves the current value of the bitset expressed as a decimal number in the input stream. If no bit has been set yet, the output is zero. The function uses \int_from_bin:n if the largest index that have been set or unset is smaller then 32, and a slower implementation based on \fp_eval:n otherwise.

\bitset_show:N
\bitset_show:c

New: 2021-01-26

\bitset_show:N ⟨*bitset var*⟩

Displays the binary and decimal value of the ⟨*bitset var*⟩ on the terminal,

\bitset_log:N
\bitset_log:c

New: 2021-01-26

\bitset_log:N ⟨*bitset var*⟩

Writes the value of the ⟨*bitset var*⟩ in the log file.

Index

The italic numbers denote the pages where the corresponding entry is described, numbers underlined point to the definition, all others indicate the places where it is used.