A Proposed Standard for Matrix Metadata

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Core categories. All elements are optional: absence implies 'unknown', or 'general case'.

Metadata category: Storage Format		
Element	Value type	Description
format	char*	name of storage format
elements	integer	number of stored elements
zeros_stored	logical	are any zero elements stored?
unique	logical	is every (i,j) location specified at most once?
symmetry	"upper", "lower"	is this a symmetric matrix with only half the elements stored?
sorted	"row", "column"	are elements sorted?

Metadata category: Structural Statistics		
Element	Value type	Description
m,n,nnz	integer	size, number of nonzero
number_system	"integer", "real", "complex", "pattern"	
shape	"dense", "banded", "triangular", "diagonals"	
symmetry	logical	structural symmetry
bandwidth,	int[2]	left and right halfbandwidth
diagonals	int, int[]	number of diagonals and their locations
diagonal	"positive", "semi-pos.", "zero from"+int	zero and sign structure of diagonal
block_size	int|int*	regular/irregular block structure
single_elt_rows	int kind, int[]	type and location

Metadata category: Simple Statistics		
Element	Value type	Description
norm_1, norm_inf, norm_F	double	norms
symmetry_type	"symmetric", "anti-s.", "complex-s.", "Hermitian", "anti-H."	

Metadata category: Spectral Statistics		
Element	Value type	Description
condition	double	condition number estimate
ellipse	double[4]	centre and axes of ellipse enclosing the field of values
hessenberg	double[][]	Hessenberg matrix from a short Arnoldi run
dep_norm	double[2]	departure from normality (upper/lower bound)

Main access routines

```
int nmdDefineCategory
   (NMD_object *obj, char *category, char *source);

int nmdDefineCategoryElement
   (NMD_object *obj, char *category, char *Celement, int dtype);


int nmdHasCategory
   (NMD_object *m, char *category, int *flg);

int nmdHasElement
   (NMD_object *obj, char *category, char *Celement, int *flg);

int nmdHasElementFilled
   (NMD_object *obj, char *category, char *Celement, int *flg);


int nmdSetCategoryElement
   (NMD_object *obj,
    char *category, char *Celement, int dtype, void *val);

int nmdGetCategoryElement
   (NMD_object *m,
    char *category, char *Celement, void **value, int *dtype, int *flg);


int nmdSerialize
   (NMD_object *obj, char **buf, int *len);

int nmdDeserialize
   (char *buf, int len, NMD_object **obj, char *schema_name);

int nmdXML2HTML
   (char *xmlfile, char *xslfile, char *htmlfile);
```

Sample XML file

```
<?xml version="1.0"?>
<sansMatrix xmlns="http://www.cs.utk.edu/~efuentes/SANS">
  <name>cavity22</name>
  <melements>
    <structure>
      <symmetry>0</symmetry>
      <diagonal>4561</diagonal>
      <nnz>139239</nnz>
    </structure>
    <spectrum>
      <condition>317.304415</condition>
      <ellipse_xc>6.288412</ellipse_xc>
      <ellipse_yc>0.000000</ellipse_yc>
      <ellipse_xa>12.635169</ellipse_xa>
      <ellipse_ya>31.232227</ellipse_ya>
    </spectrum>
  </melements>
</sansMatrix>
```