Internship report

Enhancements in linear algebra in SageMath

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1 Preface

1.1 LIP6 - PolSys

From the 17th of July to the 1st of September, I had access to a computer and the servers of the research team PolSys[1] (Polynomial Systems) at the laboratory (room 26-00-338) or using SSH (Secure Shell).

Mr. Neiger and I met about 2 to 3 times a week in person or through online meetings. We also exchanged files and information either by emails or on a private GitHub repository. The relevant remarks and results were then published on GitHub following the community norms.

I had the opportunity to be in company of other interns mainly in their last year of a Master's degree, and for some, pursuing a Ph.D.

1.2 Google Summer of Code

Within the scope of this internship, I applied and got accepted in the program Google Summer of Code[2] (acceptance rate $< 5\%$) which aims to make first contributions to open source software development with guidance from community members and committers already active in the organization.

The main phase of the program is the coding period during which contributors work on their project. It starts from the 29th of May and ends on the 28th of August with a final evaluation that determines the outcome of the project. Contributors who pass this evaluation are granted with a 5400$ stipend.
The evaluation demands to provide a link that collects contributions made through the coding period and to answer questions about the program proceedings. I have made my submitted link[3] via GitHub pages.

The project proposal submitted during the application period in April is given at the end of this report. It gathers initial goals and milestones that structure the project continuity.

1.3 SageMath

The open source organization we chose to contribute to is SageMath [1]. It is free software covering many mathematics fields, such as linear algebra, and seeks to allow access to multiple packages and libraries through a common, Python-based language or directly via interfaces or wrappers.
Its entire codebase is available on GitHub.

I was first introduced to SageMath through a user experience during the project of a teaching unit that involved the study of the modular composition of univariate polynomials[4].

[1] https://www-polsys.lip6.fr/
[2] https://summerofcode.withgoogle.com/
[3] https://marizee.github.io/GSoC-2023/
[4] https://github.com/marizee/Projet-LU2IN013-2023

2 GitHub links to contribution

This section gathers all the links to the merge requests between branches of my forked repository of SageMath[5], where the commits are made, and the official one. The issues related to the pull requests are also given if one wants to have a more complete context.

Value of `MAX_MODULUS`

Class float (Section 3.2)

- Issue #35365: "Misleading maximum `n` value in docstring of `matrix_modn_dense_float.pyx`" (Closed).
- Pull request #35752: "Clarification on the `MAX_MODULUS` of float matrices modulo n" (Merged).

Class double (Section 3.3)

- Issue #35806: "Extend `MAX_MODULUS` for `matrix_modn_dense_double.pyx` from 23 bits to 27 bits" (Closed).
- Pull request #35855: "Extend `MAX_MODULUS` of `matrix_modn_dense_double.pyx`" (Merged).

Zero matrix creation

- Issue #36065: "Matrix creation from a scalar fails in some cases" (Closed).
- Issue #28432: "Speed-up constructor of Matrix_modn_dense_template" (Closed).
- Issue #35961: "Accelerating the construction of matrices of type Matrix_modn_dense" (Closed).

Method `zero_matrix()` (Section 4.2)

- Pull request #36093: "Speed-up the creation of a zero matrix of type `Matrix_modn_dense_template`" (Merged).

Entries type (Section 4.3)

- Pull request #36068: "Speed-up matrix construction by ensuring MatrixArgs type MA_ENTRIES_ZERO" (Merged).

Zero matrix copy (Section 4.4)

- Issue #36146: "Zero matrix creation: copy vs. creation" (Open).

Submatrices creation (Section 5)

- Pull request #36059 : "Speed up the creation of submatrices of Matrix_modn_dense_template matrices" (Merged).

[5] `https://github.com/marizee/sage`

3 Update the value of MAX_MODULUS

3.1 Short description

For small-enough values of n, to represent dense matrices with coefficients in $\mathbb{Z}/n\mathbb{Z}$, SageMath relies on the library FFLAS-FFPACK, which itself encodes these matrices as an array of floating-point numbers, either double precision (64 bits) or single precision (32 bits) depending on the modulus n (for more details, one can refer to [2]). This corresponds to the templated class `Matrix_modn_dense_template`.

When n is too large for this approach, SageMath falls back to generic implementations of matrix arithmetic, with the class `Matrix_generic_dense`.

In this document, we only focus on the case where FFLAS-FFPACK is called.

The variable `MAX_MODULUS` holds the threshold values between these classes.

3.2 Single precision (Matrix_modn_dense_float)

The maximum value of n allowed for this representation is set at 2^8.

```
# mats[k] is over prime field with k-bit modulus
sage: mats = [0]*5 + [random_matrix(GF(previous_prime(2**k)), 1000, 1000) for k in range
(5,21)]
sage: %timeit B = copy(mats[8]); B.echelonize()
16.9 ms ± 173 µs per loop (mean ± std. dev. of 7 runs, 100 loops each)
sage: %timeit B = copy(mats[9]); B.echelonize()
43.7 ms ± 273 µs per loop (mean ± std. dev. of 7 runs, 10 loops each)
sage: %timeit B = copy(mats[10]); B.echelonize()
50.2 ms ± 755 µs per loop (mean ± std. dev. of 7 runs, 10 loops each)
sage: %timeit B = copy(mats[11]); B.echelonize()
50.2 ms ± 275 µs per loop (mean ± std. dev. of 7 runs, 10 loops each)
sage: %timeit B = copy(mats[12]); B.echelonize()
50.5 ms ± 694 µs per loop (mean ± std. dev. of 7 runs, 10 loops each)
```

Getting the class of the matrices allows to highlight this switch:

```
sage: type(mats[8])
<class 'sage.matrix.matrix_modn_dense_float.Matrix_modn_dense_float'>
sage: type(mats[9])
<class 'sage.matrix.matrix_modn_dense_double.Matrix_modn_dense_double'>
```

However, the documentation was stating that the value of `MAX_MODULUS` is set at 2^{11}, which is possible, but for performance reasons, it is limited at 2^8.

This inconsistency regarding the source file where it is defined led to confusions about what happens with values between 2^8 and 2^{11}.

To avoid further misunderstanding, we have updated the documentation by clearly mentioning the choice of this boundary, and the switch to the double representation for upper values.

3.3 Double precision (Matrix_modn_dense_double)

Solving the previous issue led to wonder if the value of the next threshold was also outdated.

In the class `Modular_implem` of the library Givaro, an underlying library of LinBox, the variable `maxCardinality()` also embodies the maximum value allowed for double representations and is set at $94906266 = \lfloor 2^{26} \cdot \sqrt{2} + \frac{1}{2} \rfloor$ which is 4 bits bigger than the current value of `MAX_MODULUS` ($2^{23} = 8388608$).

To see if there was any reason for them to be different, we progressively increased the value of `MAX_MODULUS` until it matches with `maxCardinality()`. For each value, we measured the timings of the multiplication and the row reduced echelon form, which are basic methods for matrices, of matrices 1000x1000 over $\mathbb{Z}/n\mathbb{Z}$ with n a prime number between 2^{22} and 2^{28}:

```
sage: M = MatrixSpace(GF(n), 1000, 1000)
sage: A = M.random_element()
sage: B = M.random_element()
sage: %time C = A * B
sage: %time R = A.rref()
```

MAX_MOD	2**23		2**24		2**25		2**26		94906266	
nbits	mul	ref	mul	ref	mul	ref	mul	ref	mul	ref
23	210ms	168ms	261ms	166ms	205ms	164ms	218ms	168ms	213ms	163ms
24	1min59s	46.2s	176ms	73.7ms	178ms	79.3ms	183ms	76.5ms	173ms	74ms
25	2min8s	44.2s	2min4s	43.9s	213ms	92ms	216ms	87.8ms	217ms	83.9ms
26	2min5s	45.6s	2min2s	43.9s	2min5s	43.9s	373ms	154ms	376ms	152ms
27	2min6s	45.1s	2min	43.7s	2min5s	44.7s	2min5s	44.4s	1.61s	622ms
28	2min13s	46.9s	2min	43.6s	2min2s	44.8s	2min2s	44.2s	2min5s	44.8s

The table shows that expanding the value of `MAX_MODULUS` is pushing the slowdown one bit away without degrading any timings. This confirmed that we can update this value and allow better performances for matrices with a double representation.

4 Speed up the matrix creation

4.1 Short description

When creating a new matrix, the arguments inputted are gathered into a `MatrixArgs` object. This class was designed to have a common behavior between different implementations (base ring, dense or sparse, using one underlying library or another, ...) and also for added flexibility in the way matrices can be inputted.

A few such methods to input a matrix are highlighted in the following lines.

```
mat1 = matrix(ZZ, 2, 3)      # zero matrix
mat2 = matrix([[1,2,3],[4,5,6]])  # specified entries, guessed dimensions and base ring
mat3 = matrix(2, 3, [1,2,3,4,5,6]) # same matrix, from flat list, providing dimensions
mat4 = matrix(ZZ, 3, 3, 2)   # square matrix with 2 on diagonal
mat5 = matrix(QQ, mat2)      # converting matrix from integer to rationals
mat6 = matrix(4, 4, {(0,1):2, (3,2):5}) # from dict containing a sparse format representation
```

The matrix arguments are then "finalized", which means that all the missing attributes are derived or guessed, and the type of the entries, stored in the class attribute `typ`, is retrieved to apply the corresponding treatment and create the matrix.

The different entries' types are listed in the file `args.pyx`. In particular, `MA_ENTRIES_ZERO` stands for the zero matrix like `mat1` above, and `MA_ENTRIES_SCALAR` stands for a diagonal matrix with the same value on all diagonal entries like `mat4` above.

4.2 Zero matrix creation

Calling `zero_matrix` over `GF(9001)` was unexpectedly much slower than calling it over the rationals.

```
sage: M = MatrixSpace(GF(9001), 10000, 10000, False, None)
sage: %time mat = M.zero_matrix()
CPU times: user 1.07 s, sys: 145 ms, total: 1.21 s
Wall time: 1.21 s
```

```
sage: M = MatrixSpace(QQ, 10000, 10000, False, None)
sage: %time mat = M.zero_matrix()
CPU times: user 50.4 ms, sys: 199 ms, total: 249 ms
Wall time: 247 ms
```

Over $\mathbb{Z}/n\mathbb{Z}$, the method calls the constructor with 0 as entry, identified with `MA_ENTRIES_SCALAR` type. One may rather expect the type `MA_ENTRIES_ZERO`: this will be discussed in Section 4.3.

The loss of time comes from the constructor that visits each entry of the matrix and initializes them regardless of the entries' type, including when one is constructing the zero matrix or matrices known to be very sparse such as the identity or diagonal matrices.

To remedy this situation, rather than looping through all the matrix coefficients, we can consider making the iterator sparse by adding `sparse=True` to the arguments of the `iter()` method of the `MatrixArgs` object. With the type `MA_ENTRIES_SCALAR`, the iterator now yields a list of triplets of `SparseEntry` objects that only contains the diagonal coefficients (which are all 0 in this case). As so, we only visit and initialize n coefficients (n the matrix dimension), the diagonal ones, instead of all the $n \times n$ coefficients which is saving time by going from quadratic to linear in n.

In fact, the gain is substantial even for matrices that are quite less sparse than $\frac{n}{n^2}$. For example, as showed in Appendix A, we obtain an interesting speed-up for creating a dense matrix from a sparse representation where 10% of the entries are non-zero.

Changing the choice of iteration led to memory issues due to the fact that we allocate the memory for the matrix with a `malloc()`, but without zeroing non-diagonal entries anymore. Thus, we have considered the `calloc()` function that allocates the memory and initializes all the matrix entries to zero.

The combination of the sparse iterator and `calloc()` is faster, but it implies that all the methods creating a new matrix get a zeroed one which is not necessary in cases where we need to initialize all the entries anyway, for example when we copy an existing matrix (`__copy__()`) or when we add two matrices together (method `__add__()`). In particular, for copying, in the worst cases this led to a slowdown by a factor around 2.

Therefore, we have added the argument `zeroed_alloc` to the constructor of `Matrix_modn_dense_template` to allow the choice between the zeroing allocation or the basic one, with a `malloc()`. After this, we have checked that there is basically no slowdown anymore.

4.3 `entries=0` vs. `entries=None`

The issue begins with the comparison of creating an empty/zero matrix by calling `space.matrix()` and by calling `space()` where `space` is a matrix space.

These two approaches output exactly the same matrix, which is a zero matrix, but the latter was unexpectedly slower than the former:

```
sage: space = MatrixSpace(GF(9001), 10000, 10000)
sage: %timeit zmat = space.matrix()
18.3 µs ± 130 ns per loop (mean ± std. dev. of 7 runs, 100,000 loops each)
sage: %timeit zmat = space()
12.1 ms ± 65.8 µs per loop (mean ± std. dev. of 7 runs, 100 loops each)
sage: space() == space.matrix()
True
sage: space().is_zero()
True
```

This is in fact due to a difference between the type of the entries given to the matrix constructor.

The `space.matrix()` instruction directly initializes the matrix through `entries=None`, which is the default value of the constructor `__init__()`, with the matrix entries type `MA_ENTRIES_ZERO`.

On the other hand, `space()` calls the constructor with `entries=0` that is analyzed as `MA_ENTRIES_SCALAR` and leads to an unnecessary initialization to 0 of the diagonal coefficients.

To avoid having to modify methods in the `Parent` class, we kept the default value `entries=0` in the call to `space()` and made sure it is identified as `MA_ENTRIES_ZERO` soon enough.

4.4 Retrieve a mutable zero matrix

The matrix retrieved from a call to `zero_matrix()/zero()` is not mutable. Thus, to be able to use it, we can either make a copy with `__copy__()/copy()` or create a new matrix from scratch by calling the constructor.

This problem was first raised in the GitHub issue #11589[6] which tries to identify which method provides better performance depending on the matrix space.

We consider the lazy attribute (i.e. instead of being computed when the object is constructed, it is computed on the fly the first time it is accessed) `_copy_zero` that seems to answer the question by returning the boolean `True` in the cases where it is faster to copy the zero matrix.

[6] https://github.com/sagemath/sage/issues/11589

Although it was created for the purpose of solving the issue, it appears to be outdated as it is not used anymore anywhere in SageMath, apart from its definition.

We have started to run tests that compare the zero matrix copy (`space.zero_matrix().__copy__()`) and the zero matrix creation (`space()`) with most kinds of matrix spaces to identify how to update the attribute with the correct value.

As we ran out of time, we did not solve this issue. It is still open on GitHub[7] and needs further analysis.

5 Speed up the access to submatrices

5.1 Short description

The class `Matrix_modn_dense_template` uses a row major order[8] to store its coefficients in the attribute `_entries`. The other attribute `_matrix` contains a pointer to each row of the matrix.

For example, to access the coefficient $a_{i,j}$ of some matrix A, one can use `A[i][j]` or `*(A._entries + i*A._ncols + j)` or even `A._matrix[i][j]` where `_ncols` is the number of columns of A.

To create a submatrix from a given matrix, there are different methods allowing multiple kinds of sets of rows and columns, with different performances.

5.2 Method `submatrix()`

The method `submatrix()` takes the coordinates of the starting entry and the number of rows and columns for the submatrix. This means that we can only create submatrices from a square window of the matrix, with continuous ranges of rows and columns.

The implemented version of the method was only optimised when one can rely on the row major order in the case where the submatrix has as many columns as the matrix. This allows using one direct call to `memcpy()`. In any other case, it would call the method `matrix_from_rows_and_columns()`.

We have been able to improve the method by systematically relying on the contiguous memory storage and on one or several calls to `memcpy()`.

5.3 Methods `matrix_from_*`

The main difference between the method `submatrix()` and the set of methods

`matrix_from_rows()`, `matrix_from_columns()`, `matrix_from_rows_and_columns()`

is that the latter do not necessarily take a continuous range of rows and/or columns. They can take a non ordered set of numbers to create a submatrix. For example, for a matrix `mat` with at least 5 rows and 4 columns,

$$\texttt{mat} = \begin{bmatrix} a_{0,0} & a_{0,1} & a_{0,2} & a_{0,3} & \cdots \\ a_{1,0} & a_{1,1} & a_{1,2} & a_{1,3} & \\ a_{2,0} & a_{2,1} & a_{2,2} & a_{2,3} & \\ a_{3,0} & a_{3,1} & a_{3,2} & a_{3,3} & \\ a_{4,0} & a_{4,1} & a_{4,2} & a_{4,3} & \\ \vdots & & & & \ddots \end{bmatrix},$$

the call

```
mat.matrix_from_rows_and_columns([1,4,0],[3,2,3,1])
```

[7] https://github.com/sagemath/sage/issues/36146
[8] https://en.wikipedia.org/wiki/Row-_and_column-major_order

will return the 3×4 matrix whose coefficients are

$$\begin{bmatrix} a_{1,3} & a_{1,2} & a_{1,3} & a_{1,1} \\ a_{4,3} & a_{4,2} & a_{4,3} & a_{4,1} \\ a_{0,3} & a_{0,2} & a_{0,3} & a_{0,1} \end{bmatrix}.$$

Note that the lists of rows and columns need not be sorted and can contain duplicates.

These methods are initially defined in the file `matrix1.pyx`, as generic methods for all SageMath matrices (this file defines the base matrix class of which all specialized ones are derived, e.g. matrices over integers, over reals, over polynomials, etc.). After allocating the submatrix of the right dimensions, they call `set_unsafe()` and `get_unsafe()` to fill the entries. These two methods are supposedly fast as they don't check the validity of the arguments (i.e. no bounds-checking, or any other checks) which is why they are labeled unsafe.

After further analysis, we figured out that in the case of `Matrix_modn_dense_template` matrices, these methods are doing casts between integer and floating-point types. These casts are time-consuming, and unnecessary in this case since one can directly copy the floating-point values without going through their integer equivalent.

To avoid doing these casts without risking to affect other matrices type, we chose to override these three methods by redefining them in `matrix_modn_dense_template.pyx`. Rather than calling `get_unsafe()` and `set_unsafe()`, we directly extract the coefficients of the matrix, once again relying on the row major order storage.

6 Conclusion

6.1 Future work

The initial project proposal presents goals that could not be achieved during the allotted time.

For example, we did not look into Gaussian elimination pivoting strategies or sparse matrices computation. The reason is that we have opted for a more complete study of the zero matrix creation instead of rushing the work to reach the initial goals.

We also have to resolve the issue mentioned in Section 4.4 that requires a deeper analysis of timings and more tests.

6.2 Acknowledgements and afterwords

This internship allowed me to apply my knowledge in linear algebra and coding in Python through software development.

I would like to express my gratitude towards Mr. Neiger who offered me this opportunity, and towards the other team members and interns who were welcoming as well. They made this internship a really enjoyable and enriching professional experience.

7 References

[1] The Sage Developers. *SageMath, the Sage Mathematics Software System (Version 10.2.beta1)*, 2023. https://www.sagemath.org.

[2] Clement Pernet Jean-Guillaume Dumas, Pascal Giorgi. Dense linear algebra over word-size prime fields: the fflas and ffpack packages. https://dl.acm.org/doi/10.1145/1391989.1391992, October 2008.

A Overall results

The table below shows ratios between timings with SageMath version 10.0 (before enhancements) and timings with version 10.2.beta1 (right at the end of the GSoC coding period).

The timings have been computed by running a script in SageMath. It first defines a function that takes the instruction we want to measure and computes the average timing by dividing the total timing by the number of iterations output from the call to `Timer()`.

```
def my_timer(str_to_time):
    number, timing = Timer(stmt=str_to_time, globals=globals()).autorange()
    return timing/number
```

We then loop through lists of matrix spaces and matrix dimensions. The outputs from the calls to `my_timer()` are appended to a list that is subsequently stored as the value of the key `(space, row_dim, column_dim)` in a dictionary that is saved in a `.sobj` file which can be easily loaded and made accessible inside SageMath.

Finally, we run another script that opens the dictionaries by loading their `.sobj` file and computes the ratio $\frac{\text{old timing}}{\text{new timing}}$.

The measurements are made with matrix spaces with coefficients in $\mathbb{Z}/n\mathbb{Z}$ using the classes `GF(n)` and `IntegerModRing(n)`. We chose prime and non prime numbers for n with a growing bit size, covering the whole range of moduli supported by the class `Matrix_modn_dense_double`, as discussed in Section 3.

The identity matrix and diagonal matrices can only be square. Thus, when dealing with non-square matrices, NaN (Not a value) is outputted for the methods that compute these matrices.

Colors are used to help identifying the improvements or regressions; they can roughly be interpreted as follows:

[0,0.1[	[0.1,0.5[	[0.5,0.8[	[0.8,1.25[	[1.25,2[	[2,10[	[10, ∞[
Disaster	Failure	Worse	Similar	Better	Success	Amazing

The columns give the ratios for the following tasks:

- `copy`: creating a (deep) copy of a matrix,
- `rd_mat`: creating a uniformly random matrix,
- `zmat`: creating the zero matrix by calling the function `zero_matrix()`,
- `cp_zero`: creating the zero matrix via a copy of the cached zero matrix,
- `()`: creating a zero matrix by calling the constructor with `None`,
- `(0)`: creating a zero matrix by calling the constructor with `0`,
- `id_mat`: creating the identity matrix by calling the function `identity_matrix()`,
- `(1)`: creating the identity matrix by calling the constructor with `1`,
- `(rd)`: creating a `rd*Id` matrix, `rd` a random element, by calling the constructor with `rd`,
- `diag_rd`: creating a diagonal matrix with given random elements on the diagonal,
- `SEQ`: creating a matrix from a numpy matrix,
- `FLAT`: creating a matrix from a list of all its entries (dense representation),
- `SP_001`: creating a matrix from the sparse representation of a matrix with density about 0.001,
- `SP_01`: creating a matrix from the sparse representation of a matrix with density about 0.01,
- `SP_1`: creating a matrix from the sparse representation of a matrix with density about 0.1,
- `MATRIX`: creating a matrix by calling the constructor with another matrix.

The results are generally positive or neutral. On many instances, the speed-up is more than 10, and in some cases it is way beyond this, regularly exceeding 10 000 for natural ways to create the zero square matrix of dimensions a few thousands (which is not huge: for such a matrix, Gaussian elimination takes only a couple of seconds on a laptop).

The ratios for FLAT are not favorable: this is an expected consequence of changing the iterator from dense to sparse. The ratio remains above 0.5, meaning that “only” a factor of at most 2 is lost.

Moreover, copying a matrix also appears slightly slower (ratio between 0.8 and 0.9) than before, for matrix dimensions up to a few hundreds. This is likely due to the added branching between a `calloc()` or a `malloc()` (see Section 4.2). This copy slowdown only occurs for the `Matrix_modn_dense_float` variant, that is, for moduli with 8 bits at most.

These two negative outcomes have to be studied further, to see if the ratios could be made closer to 1, in particular for the FLAT creation of a matrix.

Finally, we note that some of the ratios for moduli beyond 8388607 (23 bits) have to be considered with care.

Recall that our changes have increased the maximum modulus from 23 to 27 bits, for `Matrix_modn_dense_double` matrices. This means that the ratios for moduli having more than 23 bits are comparing quite different implementations. This explains why some of the ratios do not resemble those found in previous tables, with moduli having at most 23 bits. For example, the `rd_mat` column shows that random matrix creation has become much faster for 24-27 bits moduli.

However FLAT creation ratios are even a bit worse, losing a factor of almost 4 (instead of 2 mentioned above), which is explained by more type conversions in the new version which resorts to machine doubles.

Still for 24-27 moduli, copying a matrix is generally substantially faster with the new version (speed-up factor most often exceeding 3), except for matrices with a small number of entries where a factor of 2 is lost; at the moment, we do not have an explanation for this fact.

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
5	5	5	8.1e-1	8.7e-1	9.3e-1	8.2e-1	1.1e+0	1.1e+0	9.3e-1	1.0e+0	1.0e+0	8.4e-1	9.1e-1	8.1e-1	1.0e+0	9.9e-1	9.9e-1	8.9e-1
5	2	5	8.2e-1	8.5e-1	9.4e-1	8.3e-1	9.7e-1	1.0e+0	NaN	NaN	NaN	NaN	9.0e-1	8.5e-1	9.6e-1	9.4e-1	9.7e-1	8.6e-1
5	5	2	8.0e-1	8.4e-1	9.5e-1	8.1e-1	9.5e-1	9.8e-1	NaN	NaN	NaN	NaN	9.1e-1	8.6e-1	9.6e-1	1.0e+0	1.0e+0	1.1e+0
5	1	5	1.3e+0	1.3e+0	1.4e+0	1.3e+0	1.6e+0	1.3e+0	NaN	NaN	NaN	NaN	1.3e+0	8.5e-1	9.6e-1	9.4e-1	9.3e-1	8.6e-1
5	5	1	8.0e-1	8.7e-1	9.1e-1	8.3e-1	9.5e-1	9.3e-1	NaN	NaN	NaN	NaN	9.4e-1	8.3e-1	9.7e-1	9.4e-1	9.7e-1	8.8e-1
5	10	10	8.1e-1	8.7e-1	1.0e+0	8.2e-1	1.4e+0	1.5e+0	1.0e+0	1.3e+0	1.3e+0	8.5e-1	9.1e-1	7.5e-1	1.2e+0	1.2e+0	1.1e+0	8.7e-1
5	5	10	8.2e-1	8.7e-1	1.0e+0	8.2e-1	1.2e+0	1.3e+0	NaN	NaN	NaN	NaN	9.2e-1	8.0e-1	1.1e+0	1.1e+0	1.0e+0	8.9e-1
5	10	5	8.2e-1	8.8e-1	9.7e-1	8.1e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.3e-1	8.0e-1	1.1e+0	1.1e+0	1.1e+0	8.9e-1
5	1	10	8.3e-1	8.8e-1	9.4e-1	8.5e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.4e-1	8.5e-1	1.0e+0	9.7e-1	9.7e-1	9.0e-1
5	10	1	8.5e-1	8.6e-1	9.7e-1	8.5e-1	1.0e+0	1.1e+0	NaN	NaN	NaN	NaN	9.3e-1	8.7e-1	9.6e-1	9.8e-1	9.7e-1	8.8e-1
5	25	25	8.3e-1	8.7e-1	1.8e+0	8.2e-1	3.7e+0	3.7e+0	1.6e+0	2.8e+0	3.0e+0	9.0e-1	9.3e-1	6.2e-1	2.5e+0	2.4e+0	2.1e+0	8.9e-1
5	12	25	8.5e-1	8.9e-1	1.4e+0	8.7e-1	2.7e+0	2.7e+0	NaN	NaN	NaN	NaN	9.5e-1	7.3e-1	1.7e+0	1.7e+0	1.6e+0	8.8e-1
5	25	12	8.7e-1	8.9e-1	1.4e+0	8.9e-1	2.8e+0	2.8e+0	NaN	NaN	NaN	NaN	9.5e-1	6.9e-1	1.7e+0	1.7e+0	1.6e+0	8.7e-1
5	1	25	8.4e-1	8.8e-1	1.0e+0	8.6e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.5e-1	8.6e-1	1.0e+0	1.0e+0	1.0e+0	8.7e-1
5	25	1	8.3e-1	8.9e-1	9.7e-1	8.4e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.4e-1	8.3e-1	1.0e+0	1.0e+0	1.0e+0	8.9e-1
5	50	50	8.7e-1	9.1e-1	4.4e+0	8.6e-1	1.1e+1	1.1e+1	3.6e+0	7.2e+0	7.7e+0	9.0e-1	9.4e-1	5.7e-1	7.1e+0	6.4e+0	4.8e+0	8.9e-1
5	25	50	8.8e-1	9.0e-1	2.8e+0	8.8e-1	7.7e+0	8.0e+0	NaN	NaN	NaN	NaN	9.3e-1	5.8e-1	4.1e+0	3.8e+0	3.1e+0	8.9e-1
5	50	25	8.6e-1	9.0e-1	2.9e+0	9.3e-1	7.9e+0	8.1e+0	NaN	NaN	NaN	NaN	9.3e-1	5.9e-1	4.0e+0	3.8e+0	3.2e+0	8.9e-1
5	1	50	8.3e-1	8.8e-1	9.9e-1	8.5e-1	1.2e+0	1.3e+0	NaN	NaN	NaN	NaN	9.4e-1	8.1e-1	1.1e+0	1.1e+0	1.1e+0	8.7e-1
5	50	1	8.2e-1	8.9e-1	1.0e+0	8.4e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.3e-1	8.2e-1	1.1e+0	1.1e+0	1.1e+0	8.9e-1
5	100	100	8.4e-1	9.2e-1	1.3e+1	9.2e-1	3.3e+1	3.4e+1	1.0e+1	1.8e+1	1.9e+1	9.2e-1	9.5e-1	5.5e-1	2.2e+1	1.9e+1	8.0e+0	9.1e-1
5	50	100	8.9e-1	9.2e-1	8.4e+0	8.3e-1	2.4e+1	2.4e+1	NaN	NaN	NaN	NaN	9.8e-1	5.7e-1	1.3e+1	1.1e+1	6.3e+0	9.2e-1
5	100	50	9.0e-1	9.3e-1	8.4e+0	8.9e-1	2.5e+1	2.6e+1	NaN	NaN	NaN	NaN	9.5e-1	5.4e-1	1.2e+1	1.1e+1	6.6e+0	8.9e-1
5	1	100	8.3e-1	8.7e-1	1.1e+0	8.5e-1	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	9.2e-1	7.5e-1	1.2e+0	1.2e+0	1.1e+0	8.7e-1
5	100	1	8.5e-1	8.8e-1	1.1e+0	8.5e-1	1.6e+0	1.6e+0	NaN	NaN	NaN	NaN	9.6e-1	7.7e-1	1.2e+0	1.2e+0	1.2e+0	8.8e-1
5	250	250	9.5e-1	9.5e-1	5.4e+1	9.6e-1	9.4e+1	9.6e+1	3.4e+1	4.8e+1	4.9e+1	9.0e-1	9.4e-1	5.3e-1	8.5e+1	4.7e+1	1.2e+1	9.4e-1
5	125	250	9.2e-1	9.3e-1	3.6e+1	9.2e-1	8.1e+1	8.2e+1	NaN	NaN	NaN	NaN	9.4e-1	5.5e-1	5.4e+1	3.5e+1	1.1e+1	9.1e-1
5	250	125	9.3e-1	9.4e-1	3.6e+1	8.8e-1	8.1e+1	7.9e+1	NaN	NaN	NaN	NaN	9.3e-1	5.3e-1	5.3e+1	3.5e+1	1.1e+1	9.3e-1
5	1	250	8.3e-1	8.8e-1	1.3e+0	8.4e-1	2.4e+0	2.4e+0	NaN	NaN	NaN	NaN	9.5e-1	6.8e-1	1.6e+0	1.6e+0	1.4e+0	9.3e-1
5	250	1	8.8e-1	9.0e-1	1.4e+0	8.9e-1	2.5e+0	2.5e+0	NaN	NaN	NaN	NaN	9.6e-1	7.2e-1	1.6e+0	1.6e+0	1.5e+0	9.1e-1
5	500	500	9.6e-1	9.4e-1	1.0e+2	9.8e-1	1.2e+2	1.3e+2	6.4e+1	7.5e+1	7.4e+1	9.5e-1	9.3e-1	5.2e-1	1.5e+2	6.5e+1	1.2e+1	9.3e-1
5	250	500	9.5e-1	9.3e-1	8.1e+1	1.4e+0	1.2e+2	1.2e+2	NaN	NaN	NaN	NaN	9.4e-1	5.3e-1	1.2e+2	5.9e+1	1.2e+1	9.5e-1
5	500	250	9.6e-1	9.4e-1	8.0e+1	9.6e-1	1.2e+2	1.2e+2	NaN	NaN	NaN	NaN	9.1e-1	5.3e-1	1.2e+2	5.9e+1	1.2e+1	9.5e-1
5	1	500	8.6e-1	9.0e-1	1.7e+0	8.9e-1	3.8e+0	3.8e+0	NaN	NaN	NaN	NaN	9.2e-1	6.4e-1	2.1e+0	2.1e+0	2.0e+0	8.9e-1
5	500	1	9.0e-1	9.2e-1	1.8e+0	9.0e-1	3.7e+0	3.9e+0	NaN	NaN	NaN	NaN	9.3e-1	6.6e-1	2.2e+0	2.2e+0	2.0e+0	9.3e-1
5	1000	1000	9.5e-1	9.5e-1	1.2e+2	1.3e+0	1.3e+2	1.3e+2	9.0e+1	9.6e+1	9.8e+1	1.1e+0	9.4e-1	5.2e-1	1.8e+2	6.8e+1	9.4e+0	9.5e-1
5	500	1000	9.6e-1	9.6e-1	1.2e+2	9.7e-1	1.3e+2	1.3e+2	NaN	NaN	NaN	NaN	9.6e-1	5.2e-1	1.7e+2	6.8e+1	1.2e+1	9.5e-1
5	1000	500	9.7e-1	9.4e-1	1.1e+2	9.5e-1	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	9.3e-1	5.1e-1	1.8e+2	7.1e+1	1.2e+1	1.0e+0
5	1	1000	8.6e-1	9.2e-1	2.5e+0	8.6e-1	6.6e+0	6.5e+0	NaN	NaN	NaN	NaN	9.3e-1	5.9e-1	3.4e+0	3.4e+0	2.8e+0	8.7e-1
5	1000	1	9.1e-1	9.4e-1	2.6e+0	9.3e-1	5.7e+0	5.7e+0	NaN	NaN	NaN	NaN	9.5e-1	6.0e-1	3.4e+0	3.3e+0	2.9e+0	9.5e-1
5	2500	2500	1.0e+0	9.5e-1	8.4e+1	1.8e+0	8.4e+1	8.5e+1	7.5e+1	7.6e+1	7.6e+1	1.6e+0	9.4e-1	5.0e-1	1.2e+2	4.6e+1	8.4e+0	1.1e+0
5	1250	2500	1.0e+0	9.5e-1	8.1e+1	1.0e+0	8.3e+1	8.3e+1	NaN	NaN	NaN	NaN	9.3e-1	5.3e-1	1.3e+2	4.0e+1	8.6e+0	1.1e+0
5	2500	1250	1.1e+0	9.5e-1	8.2e+1	1.1e+0	8.4e+1	8.4e+1	NaN	NaN	NaN	NaN	9.5e-1	5.1e-1	1.3e+2	4.7e+1	8.1e+0	1.0e+0
5	1	2500	9.1e-1	9.3e-1	4.8e+0	9.1e-1	1.3e+1	1.4e+1	NaN	NaN	NaN	NaN	9.6e-1	5.5e-1	6.8e+0	6.7e+0	4.6e+0	9.1e-1
5	2500	1	9.4e-1	9.3e-1	4.6e+0	9.4e-1	9.7e+0	9.9e+0	NaN	NaN	NaN	NaN	9.2e-1	5.9e-1	6.6e+0	6.6e+0	4.5e+0	9.2e-1
5	5000	5000	1.0e+0	9.5e-1	1.5e+4	1.1e+0	2.5e+4	2.5e+4	6.3e+1	6.2e+1	6.3e+1	1.1e+0	9.5e-1	5.7e-1	3.6e+1	1.9e+1	7.1e+0	9.9e-1
5	2500	5000	1.0e+0	9.6e-1	8.8e+3	1.0e+0	1.7e+4	1.7e+4	NaN	NaN	NaN	NaN	9.4e-1	5.4e-1	3.4e+1	1.8e+1	6.9e+0	9.9e-1
5	5000	2500	9.8e-1	9.6e-1	8.1e+3	1.1e+0	1.4e+4	1.4e+4	NaN	NaN	NaN	NaN	9.6e-1	5.5e-1	3.4e+1	1.8e+1	6.9e+0	9.8e-1
5	1	5000	8.9e-1	9.3e-1	8.2e+0	8.9e-1	2.3e+1	2.2e+1	NaN	NaN	NaN	NaN	9.4e-1	5.5e-1	1.2e+1	1.2e+1	6.2e+0	9.0e-1
5	5000	1	9.1e-1	9.4e-1	6.9e+0	9.4e-1	1.3e+1	1.3e+1	NaN	NaN	NaN	NaN	9.4e-1	5.8e-1	1.0e+1	9.5e+0	6.0e+0	9.3e-1
5	10000	10000	1.0e+0	9.7e-1	4.9e+4	1.0e+0	7.2e+4	7.2e+4	1.3e+2	1.3e+2	1.3e+2	1.0e+0	9.4e-1	5.3e-1	4.0e+1	2.1e+1	7.3e+0	9.9e-1
5	5000	10000	1.0e+0	9.7e-1	3.1e+4	1.1e+0	5.4e+4	5.4e+4	NaN	NaN	NaN	NaN	9.4e-1	5.4e-1	3.6e+1	2.0e+1	7.6e+0	1.0e+0
5	10000	5000	1.0e+0	9.7e-1	2.7e+4	1.1e+0	4.2e+4	4.2e+4	NaN	NaN	NaN	NaN	9.3e-1	5.7e-1	3.7e+1	2.0e+1	7.4e+0	1.0e+0
5	1	10000	9.3e-1	9.4e-1	1.5e+1	9.8e-1	4.3e+1	4.3e+1	NaN	NaN	NaN	NaN	9.3e-1	5.5e-1	2.3e+1	2.0e+1	8.4e+0	9.8e-1
5	10000	1	9.2e-1	9.3e-1	1.1e+1	9.3e-1	1.7e+1	1.6e+1	NaN	NaN	NaN	NaN	9.5e-1	5.8e-1	1.5e+1	1.4e+1	7.6e+0	9.5e-1

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
6	5	5	8.5e-1	9.3e-1	1.0e+0	8.6e-1	1.1e+0	1.1e+0	9.9e-1	1.1e+0	1.0e+0	8.9e-1	9.8e-1	8.6e-1	1.1e+0	1.1e+0	1.1e+0	9.3e-1
6	2	5	8.5e-1	9.1e-1	9.6e-1	8.4e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.9e-1	8.9e-1	1.0e+0	1.1e+0	1.0e+0	9.5e-1
6	5	2	8.3e-1	9.1e-1	9.9e-1	8.3e-1	1.0e+0	1.1e+0	NaN	NaN	NaN	NaN	9.8e-1	9.0e-1	1.0e+0	1.0e+0	1.0e+0	9.1e-1
6	1	5	8.4e-1	9.1e-1	1.0e+0	8.5e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.8e-1	9.0e-1	1.0e+0	1.0e+0	1.0e+0	9.4e-1
6	5	1	8.3e-1	9.1e-1	9.9e-1	8.4e-1	9.9e-1	1.0e+0	NaN	NaN	NaN	NaN	9.7e-1	9.0e-1	1.0e+0	1.0e+0	1.0e+0	9.4e-1
6	10	10	8.3e-1	9.2e-1	1.1e+0	8.3e-1	1.5e+0	1.5e+0	1.1e+0	1.3e+0	1.3e+0	8.7e-1	9.7e-1	7.7e-1	1.3e+0	1.3e+0	1.2e+0	9.5e-1
6	5	10	8.3e-1	9.3e-1	1.0e+0	8.5e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.7e-1	8.2e-1	1.1e+0	1.1e+0	1.1e+0	9.5e-1
6	10	5	8.4e-1	9.2e-1	1.0e+0	8.4e-1	1.2e+0	1.3e+0	NaN	NaN	NaN	NaN	9.9e-1	8.7e-1	1.1e+0	1.2e+0	1.1e+0	9.1e-1
6	1	10	8.5e-1	9.1e-1	1.0e+0	8.5e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.7e-1	9.1e-1	1.1e+0	1.0e+0	1.0e+0	9.2e-1
6	10	1	8.4e-1	9.3e-1	1.0e+0	8.7e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.8e-1	9.1e-1	9.9e-1	1.0e+0	1.0e+0	9.4e-1
6	25	25	8.5e-1	9.0e-1	1.9e+0	8.8e-1	3.8e+0	3.8e+0	1.8e+0	2.9e+0	3.1e+0	9.2e-1	9.3e-1	6.2e-1	2.6e+0	2.6e+0	2.3e+0	9.4e-1
6	12	25	8.6e-1	9.1e-1	1.5e+0	8.9e-1	2.8e+0	2.9e+0	NaN	NaN	NaN	NaN	9.2e-1	7.0e-1	1.8e+0	1.8e+0	1.7e+0	9.2e-1
6	25	12	8.9e-1	9.4e-1	1.6e+0	9.5e-1	2.8e+0	2.9e+0	NaN	NaN	NaN	NaN	9.4e-1	6.9e-1	1.8e+0	1.9e+0	1.7e+0	9.5e-1
6	1	25	8.5e-1	9.2e-1	1.0e+0	8.4e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.5e-1	8.7e-1	1.1e+0	1.1e+0	1.1e+0	9.2e-1
6	25	1	8.4e-1	9.3e-1	1.0e+0	8.4e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.4e-1	8.7e-1	1.1e+0	1.1e+0	1.1e+0	9.8e-1
6	50	50	8.9e-1	9.2e-1	4.6e+0	9.1e-1	1.1e+1	1.1e+1	3.8e+0	7.4e+0	7.9e+0	9.1e-1	9.4e-1	5.6e-1	7.5e+0	7.0e+0	4.8e+0	9.4e-1
6	25	50	9.1e-1	9.2e-1	3.2e+0	9.0e-1	7.7e+0	8.0e+0	NaN	NaN	NaN	NaN	9.3e-1	5.5e-1	4.3e+0	4.1e+0	3.4e+0	9.2e-1
6	50	25	9.0e-1	9.2e-1	3.2e+0	8.8e-1	8.0e+0	7.9e+0	NaN	NaN	NaN	NaN	9.3e-1	5.9e-1	4.2e+0	4.3e+0	3.4e+0	9.1e-1
6	1	50	8.2e-1	9.1e-1	1.1e+0	8.4e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.6e-1	8.3e-1	1.1e+0	1.1e+0	1.1e+0	9.3e-1
6	50	1	8.5e-1	9.1e-1	1.1e+0	8.5e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.4e-1	8.4e-1	1.1e+0	1.1e+0	1.1e+0	9.5e-1
6	100	100	9.4e-1	9.4e-1	1.4e+1	9.7e-1	3.4e+1	3.3e+1	1.0e+1	1.8e+1	2.0e+1	9.1e-1	9.3e-1	5.4e-1	2.4e+1	2.0e+1	8.4e+0	9.4e-1
6	50	100	8.7e-1	9.2e-1	8.7e+0	8.8e-1	2.3e+1	2.3e+1	NaN	NaN	NaN	NaN	9.4e-1	5.4e-1	1.3e+1	1.2e+1	6.5e+0	9.0e-1
6	100	50	8.8e-1	9.3e-1	8.8e+0	9.2e-1	2.2e+1	2.3e+1	NaN	NaN	NaN	NaN	9.3e-1	5.4e-1	1.3e+1	1.1e+1	6.7e+0	9.0e-1
6	1	100	8.4e-1	9.3e-1	1.1e+0	8.6e-1	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	9.3e-1	7.7e-1	1.2e+0	1.3e+0	1.2e+0	9.2e-1
6	100	1	8.3e-1	9.3e-1	1.2e+0	8.5e-1	1.6e+0	1.6e+0	NaN	NaN	NaN	NaN	9.4e-1	7.9e-1	1.3e+0	1.3e+0	1.3e+0	9.3e-1
6	250	250	1.1e+0	9.3e-1	5.6e+1	1.1e+0	9.6e+1	9.7e+1	3.4e+1	4.9e+1	5.0e+1	9.7e-1	9.4e-1	5.3e-1	9.4e+1	5.3e+1	1.2e+1	1.0e+0
6	125	250	9.7e-1	9.3e-1	3.9e+1	1.0e+0	8.0e+1	7.9e+1	NaN	NaN	NaN	NaN	9.2e-1	5.2e-1	5.9e+1	4.0e+1	1.1e+1	1.0e+0
6	250	125	9.3e-1	9.4e-1	3.9e+1	1.0e+0	7.9e+1	7.9e+1	NaN	NaN	NaN	NaN	9.5e-1	5.2e-1	5.7e+1	3.7e+1	1.1e+1	9.8e-1
6	1	250	8.2e-1	9.2e-1	1.4e+0	8.5e-1	2.4e+0	2.3e+0	NaN	NaN	NaN	NaN	9.4e-1	6.9e-1	1.6e+0	1.7e+0	1.5e+0	9.5e-1
6	250	1	9.1e-1	9.3e-1	1.4e+0	8.9e-1	2.5e+0	2.5e+0	NaN	NaN	NaN	NaN	9.3e-1	7.2e-1	1.7e+0	1.7e+0	1.6e+0	9.2e-1
6	500	500	1.0e+0	9.3e-1	1.0e+2	1.0e+0	1.3e+2	1.3e+2	6.8e+1	7.8e+1	7.9e+1	9.6e-1	9.7e-1	5.1e-1	1.6e+2	6.6e+1	1.2e+1	1.0e+0
6	250	500	1.0e+0	9.5e-1	8.7e+1	1.0e+0	1.2e+2	1.2e+2	NaN	NaN	NaN	NaN	9.3e-1	5.5e-1	1.2e+2	5.9e+1	1.2e+1	1.0e+0
6	500	250	1.0e+0	9.4e-1	8.6e+1	1.0e+0	1.2e+2	1.2e+2	NaN	NaN	NaN	NaN	9.4e-1	5.2e-1	1.3e+2	6.1e+1	1.2e+1	1.0e+0
6	1	500	8.7e-1	9.4e-1	1.9e+0	9.0e-1	3.9e+0	3.9e+0	NaN	NaN	NaN	NaN	9.3e-1	6.2e-1	2.4e+0	2.4e+0	2.2e+0	9.3e-1
6	500	1	9.0e-1	9.3e-1	2.0e+0	9.1e-1	3.9e+0	3.9e+0	NaN	NaN	NaN	NaN	9.2e-1	6.7e-1	2.3e+0	2.3e+0	2.1e+0	9.4e-1
6	1000	1000	1.0e+0	9.6e-1	1.3e+2	1.0e+0	1.4e+2	1.4e+2	9.8e+1	1.0e+2	1.1e+2	1.0e+0	9.4e-1	4.9e-1	2.0e+2	7.3e+1	1.0e+1	1.0e+0
6	500	1000	1.1e+0	9.4e-1	1.2e+2	1.0e+0	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	9.7e-1	5.0e-1	1.9e+2	6.8e+1	1.2e+1	1.0e+0
6	1000	500	1.1e+0	9.6e-1	1.2e+2	1.1e+0	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	9.5e-1	5.4e-1	1.8e+2	7.5e+1	1.2e+1	1.0e+0
6	1	1000	8.7e-1	9.2e-1	2.6e+0	8.7e-1	6.4e+0	6.3e+0	NaN	NaN	NaN	NaN	9.3e-1	6.1e-1	3.6e+0	3.4e+0	2.9e+0	9.4e-1
6	1000	1	8.6e-1	9.2e-1	2.7e+0	9.1e-1	5.8e+0	5.7e+0	NaN	NaN	NaN	NaN	9.3e-1	6.0e-1	3.6e+0	3.4e+0	2.9e+0	9.4e-1
6	2500	2500	9.6e-1	9.6e-1	7.8e+1	1.1e+0	8.2e+1	8.1e+1	7.2e+1	7.4e+1	7.3e+1	1.1e+0	9.4e-1	5.0e-1	1.1e+2	4.4e+1	8.2e+0	9.2e-1
6	1250	2500	1.1e+0	9.5e-1	8.0e+1	1.1e+0	8.1e+1	8.1e+1	NaN	NaN	NaN	NaN	9.6e-1	5.0e-1	1.3e+2	4.6e+1	7.9e+0	1.0e+0
6	2500	1250	1.1e+0	9.7e-1	8.0e+1	1.1e+0	8.2e+1	8.2e+1	NaN	NaN	NaN	NaN	9.5e-1	5.0e-1	1.4e+2	4.6e+1	7.9e+0	1.0e+0
6	1	2500	9.1e-1	9.4e-1	5.2e+0	9.4e-1	1.4e+1	1.4e+1	NaN	NaN	NaN	NaN	9.4e-1	5.6e-1	7.5e+0	6.9e+0	4.6e+0	9.3e-1
6	2500	1	9.2e-1	9.3e-1	4.8e+0	9.5e-1	9.9e+0	9.9e+0	NaN	NaN	NaN	NaN	9.3e-1	5.9e-1	6.5e+0	6.3e+0	4.6e+0	9.7e-1
6	5000	5000	1.0e+0	9.6e-1	1.5e+4	1.1e+0	2.5e+4	2.5e+4	6.2e+1	6.2e+1	2.6e+4	1.0e+0	9.5e-1	4.9e-1	3.6e+1	1.9e+1	7.2e+0	1.0e+0
6	2500	5000	1.0e+0	9.6e-1	1.7e+2	1.0e+0	1.7e+2	1.8e+2	NaN	NaN	NaN	NaN	9.5e-1	4.9e-1	5.1e+1	2.5e+1	7.5e+0	1.0e+0
6	5000	2500	1.0e+0	9.6e-1	1.7e+2	1.0e+0	1.8e+2	1.7e+2	NaN	NaN	NaN	NaN	9.6e-1	5.3e-1	5.1e+1	2.4e+1	7.3e+0	9.9e-1
6	1	5000	9.4e-1	9.3e-1	8.9e+0	9.3e-1	2.3e+1	2.3e+1	NaN	NaN	NaN	NaN	9.4e-1	5.6e-1	1.3e+1	1.2e+1	6.8e+0	9.6e-1
6	5000	1	9.5e-1	9.5e-1	7.2e+0	9.6e-1	1.3e+1	1.3e+1	NaN	NaN	NaN	NaN	9.4e-1	5.6e-1	1.1e+1	9.8e+0	6.1e+0	9.6e-1
6	10000	10000	1.0e+0	9.7e-1	5.1e+4	1.0e+0	7.5e+4	7.4e+4	1.3e+2	1.3e+2	1.3e+2	1.0e+0	9.5e-1	5.4e-1	3.9e+1	2.1e+1	7.4e+0	9.8e-1
6	5000	10000	1.0e+0	9.6e-1	3.2e+4	1.1e+0	5.3e+4	5.4e+4	NaN	NaN	NaN	NaN	9.4e-1	5.6e-1	3.6e+1	2.0e+1	7.7e+0	1.0e+0
6	10000	5000	9.9e-1	9.7e-1	2.7e+4	1.1e+0	4.3e+4	4.2e+4	NaN	NaN	NaN	NaN	9.5e-1	5.4e-1	3.6e+1	2.0e+1	7.4e+0	1.0e+0
6	1	10000	9.2e-1	9.3e-1	1.6e+1	9.2e-1	4.0e+1	4.1e+1	NaN	NaN	NaN	NaN	9.3e-1	5.4e-1	2.5e+1	2.0e+1	8.3e+0	9.4e-1
6	10000	1	9.1e-1	9.3e-1	1.1e+1	9.4e-1	1.6e+1	1.6e+1	NaN	NaN	NaN	NaN	9.5e-1	5.8e-1	1.6e+1	1.4e+1	7.3e+0	9.4e-1

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
59	5	5	8.3e-1	8.8e-1	1.0e+0	8.3e-1	1.1e+0	1.1e+0	9.7e-1	1.1e+0	1.0e+0	8.9e-1	9.6e-1	9.0e-1	1.0e+0	1.1e+0	1.1e+0	9.2e-1
59	2	5	8.3e-1	9.0e-1	1.0e+0	8.6e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.4e-1	9.1e-1	9.9e-1	1.0e+0	1.0e+0	9.0e-1
59	5	2	8.6e-1	9.2e-1	9.9e-1	8.4e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.7e-1	9.3e-1	1.0e+0	1.0e+0	1.0e+0	9.4e-1
59	1	5	8.2e-1	8.9e-1	9.8e-1	8.4e-1	1.0e+0	9.8e-1	NaN	NaN	NaN	NaN	9.4e-1	9.1e-1	9.8e-1	1.0e+0	1.0e+0	9.1e-1
59	5	1	8.4e-1	8.9e-1	9.6e-1	8.6e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.5e-1	9.0e-1	1.0e+0	9.6e-1	9.7e-1	9.5e-1
59	10	10	8.3e-1	9.1e-1	1.1e+0	8.4e-1	1.5e+0	1.5e+0	1.0e+0	1.3e+0	1.3e+0	8.7e-1	9.7e-1	8.0e-1	1.3e+0	1.2e+0	1.3e+0	9.0e-1
59	5	10	8.3e-1	9.0e-1	1.0e+0	8.6e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.5e-1	8.5e-1	1.1e+0	1.1e+0	1.1e+0	9.4e-1
59	10	5	8.4e-1	8.9e-1	1.0e+0	8.6e-1	1.3e+0	1.2e+0	NaN	NaN	NaN	NaN	9.4e-1	8.3e-1	1.1e+0	1.1e+0	1.1e+0	9.0e-1
59	1	10	8.3e-1	9.0e-1	9.8e-1	8.4e-1	1.0e+0	9.9e-1	NaN	NaN	NaN	NaN	9.6e-1	8.9e-1	1.0e+0	1.0e+0	9.9e-1	9.3e-1
59	10	1	8.2e-1	9.0e-1	9.8e-1	8.4e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	1.0e+0	9.1e-1	1.0e+0	1.0e+0	1.0e+0	9.2e-1
59	25	25	9.2e-1	9.4e-1	1.8e+0	9.3e-1	3.8e+0	3.7e+0	1.7e+0	2.9e+0	3.1e+0	9.1e-1	9.4e-1	6.3e-1	2.6e+0	2.6e+0	2.2e+0	9.7e-1
59	12	25	8.8e-1	9.1e-1	1.5e+0	9.0e-1	2.8e+0	2.8e+0	NaN	NaN	NaN	NaN	9.3e-1	6.9e-1	1.7e+0	1.7e+0	1.6e+0	8.7e-1
59	25	12	9.0e-1	9.3e-1	1.5e+0	8.6e-1	2.7e+0	2.7e+0	NaN	NaN	NaN	NaN	9.2e-1	7.0e-1	1.8e+0	1.8e+0	1.7e+0	9.4e-1
59	1	25	8.2e-1	8.9e-1	9.9e-1	8.4e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.7e-1	8.7e-1	1.0e+0	1.0e+0	1.1e+0	9.2e-1
59	25	1	8.3e-1	9.0e-1	1.0e+0	8.6e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.6e-1	9.1e-1	1.1e+0	1.1e+0	1.1e+0	9.3e-1
59	50	50	9.1e-1	9.3e-1	4.2e+0	9.1e-1	1.1e+1	1.1e+1	3.7e+0	7.3e+0	7.7e+0	9.1e-1	9.4e-1	5.7e-1	7.0e+0	6.3e+0	4.6e+0	9.3e-1
59	25	50	8.2e-1	9.1e-1	3.0e+0	8.8e-1	7.8e+0	7.9e+0	NaN	NaN	NaN	NaN	9.4e-1	5.7e-1	4.0e+0	3.8e+0	3.2e+0	9.2e-1
59	50	25	8.4e-1	9.1e-1	3.0e+0	8.5e-1	7.9e+0	7.9e+0	NaN	NaN	NaN	NaN	9.2e-1	6.0e-1	3.9e+0	3.8e+0	3.1e+0	9.2e-1
59	1	50	8.3e-1	9.0e-1	1.0e+0	8.4e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.7e-1	8.1e-1	1.1e+0	1.1e+0	1.1e+0	9.2e-1
59	50	1	8.3e-1	8.9e-1	1.0e+0	8.5e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.7e-1	8.5e-1	1.1e+0	1.1e+0	1.1e+0	9.0e-1
59	100	100	9.0e-1	9.3e-1	1.3e+1	8.8e-1	3.2e+1	3.3e+1	1.0e+1	1.8e+1	1.9e+1	9.1e-1	9.2e-1	5.4e-1	2.3e+1	1.9e+1	8.1e+0	9.6e-1
59	50	100	7.9e-1	9.2e-1	8.3e+0	8.1e-1	2.3e+1	2.3e+1	NaN	NaN	NaN	NaN	9.2e-1	5.6e-1	1.2e+1	1.1e+1	6.2e+0	9.1e-1
59	100	50	9.4e-1	9.3e-1	8.6e+0	9.3e-1	2.4e+1	2.4e+1	NaN	NaN	NaN	NaN	9.4e-1	5.4e-1	1.2e+1	1.1e+1	6.0e+0	8.9e-1
59	1	100	8.5e-1	9.0e-1	1.1e+0	8.3e-1	1.5e+0	1.6e+0	NaN	NaN	NaN	NaN	9.3e-1	8.1e-1	1.2e+0	1.2e+0	1.2e+0	9.4e-1
59	100	1	8.5e-1	9.2e-1	1.2e+0	8.7e-1	1.6e+0	1.6e+0	NaN	NaN	NaN	NaN	9.4e-1	7.9e-1	1.2e+0	1.2e+0	1.2e+0	9.1e-1
59	250	250	1.1e+0	9.4e-1	5.4e+1	1.1e+0	1.0e+2	9.6e+1	3.4e+1	4.8e+1	5.0e+1	9.5e-1	9.5e-1	5.2e-1	9.0e+1	4.8e+1	1.1e+1	1.0e+0
59	125	250	9.2e-1	9.3e-1	3.7e+1	1.0e+0	8.1e+1	7.9e+1	NaN	NaN	NaN	NaN	9.2e-1	5.2e-1	5.4e+1	3.6e+1	1.1e+1	9.8e-1
59	250	125	9.0e-1	9.6e-1	3.6e+1	1.1e+0	7.7e+1	7.7e+1	NaN	NaN	NaN	NaN	9.1e-1	5.2e-1	5.3e+1	3.6e+1	1.0e+1	9.7e-1
59	1	250	8.4e-1	9.1e-1	1.4e+0	8.4e-1	2.4e+0	2.4e+0	NaN	NaN	NaN	NaN	9.3e-1	6.9e-1	1.5e+0	1.5e+0	1.5e+0	9.4e-1
59	250	1	8.9e-1	9.1e-1	1.4e+0	8.9e-1	2.6e+0	2.5e+0	NaN	NaN	NaN	NaN	9.5e-1	7.1e-1	1.7e+0	1.6e+0	1.6e+0	9.0e-1
59	500	500	1.0e+0	9.7e-1	1.0e+2	1.0e+0	1.3e+2	1.3e+2	6.7e+1	7.8e+1	7.9e+1	9.6e-1	9.3e-1	5.1e-1	1.5e+2	6.6e+1	1.2e+1	1.0e+0
59	250	500	1.0e+0	9.2e-1	8.5e+1	1.0e+0	1.3e+2	1.3e+2	NaN	NaN	NaN	NaN	9.3e-1	5.2e-1	1.2e+2	5.8e+1	1.1e+1	1.0e+0
59	500	250	1.0e+0	9.4e-1	8.4e+1	1.0e+0	1.2e+2	1.3e+2	NaN	NaN	NaN	NaN	9.3e-1	5.2e-1	1.2e+2	5.8e+1	1.1e+1	1.0e+0
59	1	500	8.8e-1	9.1e-1	1.8e+0	9.2e-1	3.8e+0	3.8e+0	NaN	NaN	NaN	NaN	9.4e-1	6.4e-1	2.2e+0	2.2e+0	1.9e+0	9.0e-1
59	500	1	9.0e-1	9.3e-1	1.8e+0	9.1e-1	3.8e+0	3.9e+0	NaN	NaN	NaN	NaN	9.3e-1	6.7e-1	2.2e+0	2.2e+0	2.0e+0	9.1e-1
59	1000	1000	1.0e+0	9.5e-1	1.3e+2	1.0e+0	1.4e+2	1.4e+2	9.3e+1	1.0e+2	1.0e+2	1.0e+0	9.2e-1	5.0e-1	2.0e+2	7.1e+1	9.7e+0	1.0e+0
59	500	1000	1.0e+0	9.7e-1	1.2e+2	1.0e+0	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	9.2e-1	5.0e-1	1.7e+2	6.8e+1	1.2e+1	1.0e+0
59	1000	500	1.0e+0	9.6e-1	1.2e+2	1.0e+0	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	9.2e-1	5.1e-1	1.7e+2	7.1e+1	1.2e+1	1.0e+0
59	1	1000	8.7e-1	9.2e-1	2.5e+0	8.8e-1	6.2e+0	6.2e+0	NaN	NaN	NaN	NaN	9.2e-1	5.8e-1	3.5e+0	3.5e+0	2.7e+0	9.2e-1
59	1000	1	8.9e-1	9.3e-1	2.6e+0	9.1e-1	5.7e+0	5.7e+0	NaN	NaN	NaN	NaN	9.3e-1	6.0e-1	3.3e+0	3.3e+0	2.8e+0	9.3e-1
59	2500	2500	1.0e+0	9.5e-1	8.1e+1	9.2e-1	8.3e+1	8.4e+1	7.6e+1	7.7e+1	7.8e+1	9.4e-1	9.3e-1	5.0e-1	1.2e+2	4.5e+1	8.2e+0	1.0e+0
59	1250	2500	1.0e+0	9.5e-1	7.9e+1	1.1e+0	8.2e+1	8.1e+1	NaN	NaN	NaN	NaN	9.3e-1	5.3e-1	1.3e+2	4.4e+1	7.4e+0	1.0e+0
59	2500	1250	1.0e+0	9.7e-1	7.9e+1	1.1e+0	8.2e+1	8.2e+1	NaN	NaN	NaN	NaN	9.3e-1	5.2e-1	1.3e+2	4.3e+1	7.4e+0	1.1e+0
59	1	2500	9.0e-1	9.3e-1	4.8e+0	9.4e-1	1.4e+1	1.4e+1	NaN	NaN	NaN	NaN	9.4e-1	5.6e-1	6.9e+0	6.4e+0	4.6e+0	9.4e-1
59	2500	1	9.1e-1	9.3e-1	4.5e+0	9.0e-1	9.7e+0	9.6e+0	NaN	NaN	NaN	NaN	9.3e-1	5.8e-1	6.2e+0	5.7e+0	4.3e+0	9.1e-1
59	5000	5000	1.0e+0	9.5e-1	1.5e+4	1.0e+0	2.5e+4	2.5e+4	6.1e+1	6.1e+1	6.3e+1	9.6e-1	9.2e-1	5.6e-1	3.6e+1	1.9e+1	7.2e+0	9.9e-1
59	2500	5000	9.4e-1	9.7e-1	1.8e+2	9.6e-1	1.8e+2	1.8e+2	NaN	NaN	NaN	NaN	9.5e-1	5.0e-1	5.0e+1	2.2e+1	7.1e+0	9.8e-1
59	5000	2500	9.6e-1	9.5e-1	1.8e+2	9.6e-1	1.8e+2	1.8e+2	NaN	NaN	NaN	NaN	9.6e-1	5.0e-1	5.0e+1	2.3e+1	7.2e+0	9.9e-1
59	1	5000	9.2e-1	9.2e-1	8.2e+0	8.9e-1	2.3e+1	2.3e+1	NaN	NaN	NaN	NaN	9.3e-1	5.5e-1	1.2e+1	1.1e+1	6.2e+0	9.4e-1
59	5000	1	9.4e-1	9.2e-1	7.0e+0	9.3e-1	1.3e+1	1.3e+1	NaN	NaN	NaN	NaN	9.5e-1	5.7e-1	9.9e+0	9.1e+0	6.0e+0	9.8e-1
59	10000	10000	1.0e+0	9.6e-1	4.9e+4	1.0e+0	7.5e+4	7.4e+4	1.3e+2	1.3e+2	1.3e+2	1.0e+0	9.4e-1	5.5e-1	3.9e+1	2.1e+1	7.5e+0	1.0e+0
59	5000	10000	1.0e+0	9.7e-1	3.1e+4	1.1e+0	5.4e+4	5.4e+4	NaN	NaN	NaN	NaN	9.5e-1	5.5e-1	3.6e+1	2.0e+1	7.2e+0	1.0e+0
59	10000	5000	1.0e+0	9.7e-1	2.5e+4	1.1e+0	4.1e+4	4.1e+4	NaN	NaN	NaN	NaN	9.5e-1	5.6e-1	3.5e+1	1.9e+1	7.2e+0	1.0e+0
59	1	10000	8.7e-1	9.3e-1	1.5e+1	9.3e-1	4.1e+1	4.3e+1	NaN	NaN	NaN	NaN	9.5e-1	5.3e-1	2.3e+1	1.9e+1	8.6e+0	1.0e+0
59	10000	1	9.1e-1	9.3e-1	1.0e+1	9.4e-1	1.7e+1	1.6e+1	NaN	NaN	NaN	NaN	9.5e-1	5.6e-1	1.5e+1	1.4e+1	7.5e+0	9.7e-1

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
60	5	5	8.7e-1	9.3e-1	1.0e+0	8.7e-1	1.1e+0	1.2e+0	9.7e-1	1.1e+0	1.0e+0	8.8e-1	9.5e-1	8.9e-1	1.1e+0	1.1e+0	1.1e+0	9.2e-1
60	2	5	8.3e-1	9.1e-1	9.9e-1	8.4e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.4e-1	8.8e-1	1.0e+0	1.0e+0	1.0e+0	9.8e-1
60	5	2	8.2e-1	9.4e-1	9.6e-1	8.4e-1	1.1e+0	1.0e+0	NaN	NaN	NaN	NaN	9.8e-1	8.9e-1	1.0e+0	1.0e+0	1.0e+0	9.1e-1
60	1	5	8.7e-1	9.4e-1	9.9e-1	8.5e-1	9.9e-1	1.0e+0	NaN	NaN	NaN	NaN	9.6e-1	8.8e-1	1.0e+0	1.0e+0	1.0e+0	9.2e-1
60	5	1	8.4e-1	9.6e-1	9.8e-1	8.6e-1	9.6e-1	1.0e+0	NaN	NaN	NaN	NaN	9.7e-1	9.0e-1	1.1e+0	1.0e+0	1.0e+0	9.2e-1
60	10	10	8.3e-1	9.6e-1	1.1e+0	8.4e-1	1.5e+0	1.5e+0	1.0e+0	1.3e+0	1.3e+0	8.6e-1	9.5e-1	7.9e-1	1.3e+0	1.3e+0	1.2e+0	9.2e-1
60	5	10	8.4e-1	9.2e-1	1.0e+0	8.4e-1	1.2e+0	1.3e+0	NaN	NaN	NaN	NaN	9.3e-1	8.4e-1	1.1e+0	1.1e+0	1.1e+0	9.2e-1
60	10	5	8.4e-1	9.4e-1	1.1e+0	8.5e-1	1.2e+0	1.3e+0	NaN	NaN	NaN	NaN	9.4e-1	8.2e-1	1.1e+0	1.1e+0	1.1e+0	9.2e-1
60	1	10	8.5e-1	9.0e-1	9.9e-1	8.4e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.6e-1	9.1e-1	1.0e+0	1.1e+0	1.1e+0	9.2e-1
60	10	1	8.4e-1	9.3e-1	9.8e-1	8.4e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.2e-1	9.0e-1	1.0e+0	1.1e+0	1.0e+0	9.2e-1
60	25	25	9.0e-1	9.3e-1	1.9e+0	9.0e-1	3.8e+0	3.7e+0	1.7e+0	2.9e+0	3.1e+0	8.8e-1	9.2e-1	6.3e-1	2.7e+0	2.6e+0	2.3e+0	9.2e-1
60	12	25	8.8e-1	9.2e-1	1.5e+0	9.1e-1	2.8e+0	2.8e+0	NaN	NaN	NaN	NaN	9.1e-1	7.2e-1	1.8e+0	1.8e+0	1.8e+0	9.3e-1
60	25	12	8.7e-1	9.1e-1	1.6e+0	8.9e-1	2.8e+0	2.9e+0	NaN	NaN	NaN	NaN	9.2e-1	7.2e-1	1.8e+0	1.8e+0	1.7e+0	9.2e-1
60	1	25	8.4e-1	9.4e-1	1.0e+0	8.4e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.4e-1	8.8e-1	1.1e+0	1.1e+0	1.1e+0	9.1e-1
60	25	1	8.3e-1	9.2e-1	1.0e+0	8.7e-1	1.1e+0	1.2e+0	NaN	NaN	NaN	NaN	9.1e-1	8.7e-1	1.1e+0	1.1e+0	1.1e+0	9.3e-1
60	50	50	9.2e-1	9.3e-1	4.4e+0	9.3e-1	1.1e+1	1.1e+1	3.8e+0	7.2e+0	7.8e+0	8.9e-1	9.2e-1	5.6e-1	7.4e+0	6.8e+0	4.8e+0	8.8e-1
60	25	50	8.6e-1	9.2e-1	3.1e+0	9.2e-1	8.1e+0	8.1e+0	NaN	NaN	NaN	NaN	9.5e-1	5.9e-1	4.3e+0	4.1e+0	3.3e+0	9.2e-1
60	50	25	8.6e-1	9.2e-1	3.2e+0	8.6e-1	8.0e+0	7.9e+0	NaN	NaN	NaN	NaN	9.3e-1	5.9e-1	4.2e+0	4.0e+0	3.2e+0	9.2e-1
60	1	50	8.6e-1	9.4e-1	1.0e+0	8.4e-1	1.2e+0	1.2e+0	NaN	NaN	NaN	NaN	9.4e-1	8.2e-1	1.1e+0	1.1e+0	1.1e+0	9.3e-1
60	50	1	8.2e-1	9.3e-1	1.1e+0	8.3e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.4e-1	8.5e-1	1.1e+0	1.2e+0	1.1e+0	9.3e-1
60	100	100	9.0e-1	9.2e-1	1.4e+1	9.1e-1	3.3e+1	3.3e+1	1.1e+1	1.8e+1	1.9e+1	9.2e-1	9.1e-1	5.4e-1	2.4e+1	2.0e+1	8.4e+0	1.0e+0
60	50	100	8.9e-1	9.3e-1	9.0e+0	9.2e-1	2.5e+1	2.5e+1	NaN	NaN	NaN	NaN	9.2e-1	5.6e-1	1.4e+1	1.1e+1	6.5e+0	9.3e-1
60	100	50	8.9e-1	9.3e-1	9.2e+0	9.1e-1	2.4e+1	2.4e+1	NaN	NaN	NaN	NaN	9.2e-1	5.7e-1	1.3e+1	1.2e+1	6.5e+0	9.1e-1
60	1	100	8.4e-1	9.2e-1	1.2e+0	8.5e-1	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	9.3e-1	7.9e-1	1.2e+0	1.2e+0	1.2e+0	9.0e-1
60	100	1	8.5e-1	9.6e-1	1.2e+0	8.6e-1	1.6e+0	1.6e+0	NaN	NaN	NaN	NaN	9.2e-1	8.0e-1	1.3e+0	1.3e+0	1.2e+0	9.0e-1
60	250	250	1.0e+0	9.3e-1	5.5e+1	9.9e-1	9.2e+1	9.3e+1	3.5e+1	4.8e+1	4.7e+1	9.4e-1	9.3e-1	5.3e-1	8.8e+1	5.0e+1	1.1e+1	1.0e+0
60	125	250	9.9e-1	9.3e-1	4.1e+1	1.1e+0	8.2e+1	8.3e+1	NaN	NaN	NaN	NaN	9.3e-1	5.3e-1	5.9e+1	3.8e+1	1.1e+1	9.9e-1
60	250	125	9.9e-1	9.3e-1	4.0e+1	1.1e+0	8.0e+1	7.9e+1	NaN	NaN	NaN	NaN	9.4e-1	5.3e-1	6.4e+1	3.8e+1	1.1e+1	1.0e+0
60	1	250	8.4e-1	9.2e-1	1.4e+0	8.5e-1	2.4e+0	2.4e+0	NaN	NaN	NaN	NaN	9.2e-1	7.5e-1	1.6e+0	1.7e+0	1.6e+0	9.1e-1
60	250	1	8.9e-1	9.5e-1	1.4e+0	9.3e-1	2.5e+0	2.5e+0	NaN	NaN	NaN	NaN	9.3e-1	7.4e-1	1.7e+0	1.8e+0	1.6e+0	9.3e-1
60	500	500	1.0e+0	9.6e-1	1.1e+2	1.0e+0	1.3e+2	1.3e+2	6.8e+1	8.0e+1	8.0e+1	9.6e-1	9.0e-1	5.1e-1	1.6e+2	6.8e+1	1.2e+1	1.0e+0
60	250	500	1.0e+0	9.3e-1	8.6e+1	1.1e+0	1.2e+2	1.2e+2	NaN	NaN	NaN	NaN	9.2e-1	5.2e-1	1.2e+2	5.9e+1	1.1e+1	1.0e+0
60	500	250	1.0e+0	9.3e-1	8.6e+1	1.1e+0	1.2e+2	1.2e+2	NaN	NaN	NaN	NaN	8.9e-1	5.2e-1	1.3e+2	5.9e+1	1.2e+1	1.0e+0
60	1	500	8.8e-1	9.3e-1	1.8e+0	9.0e-1	3.8e+0	3.9e+0	NaN	NaN	NaN	NaN	9.3e-1	6.4e-1	2.3e+0	2.2e+0	2.1e+0	9.0e-1
60	500	1	8.7e-1	9.3e-1	1.9e+0	8.9e-1	3.8e+0	3.8e+0	NaN	NaN	NaN	NaN	9.5e-1	6.8e-1	2.3e+0	2.3e+0	2.1e+0	9.1e-1
60	1000	1000	1.0e+0	9.5e-1	1.3e+2	1.0e+0	1.4e+2	1.4e+2	9.6e+1	1.0e+2	1.0e+2	1.0e+0	9.0e-1	5.0e-1	1.9e+2	7.5e+1	9.7e+0	1.0e+0
60	500	1000	1.0e+0	9.5e-1	1.3e+2	1.0e+0	1.4e+2	1.5e+2	NaN	NaN	NaN	NaN	9.1e-1	5.1e-1	1.8e+2	7.2e+1	1.2e+1	1.1e+0
60	1000	500	1.0e+0	9.4e-1	1.3e+2	1.0e+0	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	9.6e-1	5.0e-1	1.8e+2	7.0e+1	1.2e+1	1.1e+0
60	1	1000	8.5e-1	9.3e-1	2.6e+0	8.7e-1	6.4e+0	6.3e+0	NaN	NaN	NaN	NaN	9.0e-1	5.9e-1	3.6e+0	3.3e+0	2.9e+0	9.1e-1
60	1000	1	9.1e-1	9.3e-1	2.7e+0	9.3e-1	5.8e+0	5.9e+0	NaN	NaN	NaN	NaN	9.3e-1	6.3e-1	3.6e+0	3.5e+0	2.9e+0	9.4e-1
60	2500	2500	1.0e+0	9.6e-1	8.4e+1	1.2e+0	8.3e+1	8.3e+1	7.7e+1	7.9e+1	7.7e+1	1.1e+0	9.4e-1	5.1e-1	1.2e+2	4.6e+1	7.8e+0	9.9e-1
60	1250	2500	1.0e+0	9.7e-1	8.1e+1	1.1e+0	8.3e+1	8.0e+1	NaN	NaN	NaN	NaN	9.2e-1	5.3e-1	1.3e+2	4.4e+1	7.3e+0	1.1e+0
60	2500	1250	1.0e+0	9.5e-1	8.0e+1	1.1e+0	8.3e+1	8.0e+1	NaN	NaN	NaN	NaN	9.3e-1	5.3e-1	1.3e+2	4.3e+1	7.2e+0	1.2e+0
60	1	2500	8.4e-1	9.3e-1	5.1e+0	8.8e-1	1.3e+1	1.4e+1	NaN	NaN	NaN	NaN	9.2e-1	5.6e-1	7.2e+0	6.8e+0	4.5e+0	9.3e-1
60	2500	1	8.9e-1	9.3e-1	4.7e+0	9.3e-1	9.4e+0	9.3e+0	NaN	NaN	NaN	NaN	9.2e-1	5.8e-1	6.6e+0	6.1e+0	4.4e+0	9.0e-1
60	5000	5000	1.0e+0	9.5e-1	1.5e+4	1.0e+0	2.4e+4	2.4e+4	6.2e+1	6.1e+1	6.2e+1	1.0e+0	9.2e-1	5.6e-1	3.6e+1	1.8e+1	7.1e+0	1.0e+0
60	2500	5000	1.0e+0	9.5e-1	1.8e+2	1.0e+0	1.8e+2	1.8e+2	NaN	NaN	NaN	NaN	9.2e-1	5.2e-1	4.9e+1	2.3e+1	7.1e+0	9.9e-1
60	5000	2500	1.0e+0	9.8e-1	1.7e+2	1.0e+0	1.8e+2	1.8e+2	NaN	NaN	NaN	NaN	9.1e-1	5.4e-1	4.8e+1	2.3e+1	7.0e+0	9.8e-1
60	1	5000	1.1e+0	9.3e-1	9.2e+0	1.1e+0	2.4e+1	2.5e+1	NaN	NaN	NaN	NaN	9.2e-1	5.8e-1	1.3e+1	1.2e+1	6.4e+0	9.7e-1
60	5000	1	1.0e+0	9.6e-1	7.4e+0	1.0e+0	1.4e+1	1.4e+1	NaN	NaN	NaN	NaN	9.5e-1	5.8e-1	1.1e+1	9.9e+0	6.0e+0	1.0e+0
60	10000	10000	9.9e-1	9.7e-1	5.1e+4	1.0e+0	7.5e+4	7.4e+4	1.3e+2	1.3e+2	1.3e+2	1.0e+0	9.3e-1	5.6e-1	3.9e+1	2.0e+1	7.3e+0	9.8e-1
60	5000	10000	1.0e+0	9.6e-1	3.3e+4	1.1e+0	5.5e+4	5.4e+4	NaN	NaN	NaN	NaN	9.4e-1	5.6e-1	3.6e+1	2.0e+1	7.2e+0	1.0e+0
60	10000	5000	1.0e+0	9.8e-1	2.6e+4	1.1e+0	4.1e+4	4.0e+4	NaN	NaN	NaN	NaN	9.3e-1	5.4e-1	3.6e+1	2.0e+1	7.2e+0	1.0e+0
60	1	10000	8.8e-1	9.3e-1	1.7e+1	9.4e-1	4.2e+1	4.2e+1	NaN	NaN	NaN	NaN	9.2e-1	5.5e-1	2.4e+1	2.0e+1	8.4e+0	9.8e-1
60	10000	1	9.2e-1	9.4e-1	1.1e+1	9.3e-1	1.7e+1	1.6e+1	NaN	NaN	NaN	NaN	9.5e-1	5.9e-1	1.6e+1	1.4e+1	7.4e+0	9.8e-1

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
997	5	5	8.8e-1	9.3e-1	9.9e-1	9.2e-1	1.1e+0	1.1e+0	9.6e-1	1.0e+0	9.8e-1	9.0e-1	9.8e-1	8.6e-1	1.1e+0	1.1e+0	1.0e+0	9.3e-1
997	2	5	8.9e-1	9.6e-1	1.0e+0	9.1e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.9e-1	9.3e-1	1.0e+0	1.0e+0	1.0e+0	9.3e-1
997	5	2	8.7e-1	9.0e-1	9.9e-1	9.0e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	1.0e+0	9.1e-1	1.1e+0	1.0e+0	1.1e+0	9.5e-1
997	1	5	8.8e-1	9.4e-1	1.0e+0	8.8e-1	9.9e-1	9.8e-1	NaN	NaN	NaN	NaN	9.8e-1	9.2e-1	1.0e+0	1.0e+0	1.0e+0	9.5e-1
997	5	1	8.8e-1	9.2e-1	9.9e-1	8.9e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.9e-1	9.6e-1	1.0e+0	1.0e+0	1.0e+0	9.4e-1
997	10	10	8.9e-1	9.5e-1	1.1e+0	8.9e-1	1.4e+0	1.4e+0	1.1e+0	1.2e+0	1.3e+0	8.8e-1	9.8e-1	8.2e-1	1.3e+0	1.3e+0	1.2e+0	9.4e-1
997	5	10	8.6e-1	9.3e-1	1.1e+0	8.9e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	1.0e+0	8.6e-1	1.1e+0	1.1e+0	1.1e+0	9.6e-1
997	10	5	8.7e-1	9.5e-1	1.1e+0	8.9e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	1.0e+0	8.9e-1	1.1e+0	1.1e+0	1.1e+0	9.4e-1
997	1	10	8.6e-1	9.2e-1	1.0e+0	9.0e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	1.0e+0	9.1e-1	1.1e+0	1.0e+0	1.0e+0	9.4e-1
997	10	1	8.8e-1	9.3e-1	9.9e-1	9.2e-1	1.0e+0	1.0e+0	NaN	NaN	NaN	NaN	9.4e-1	9.3e-1	1.0e+0	1.0e+0	1.1e+0	9.6e-1
997	25	25	8.9e-1	9.6e-1	1.8e+0	9.1e-1	3.5e+0	3.5e+0	1.7e+0	2.9e+0	2.9e+0	9.3e-1	1.0e+0	6.9e-1	2.6e+0	2.5e+0	2.2e+0	9.8e-1
997	12	25	9.1e-1	9.7e-1	1.5e+0	9.7e-1	2.6e+0	2.6e+0	NaN	NaN	NaN	NaN	1.0e+0	7.5e-1	1.8e+0	1.8e+0	1.7e+0	9.7e-1
997	25	12	9.2e-1	9.5e-1	1.5e+0	9.1e-1	2.7e+0	2.7e+0	NaN	NaN	NaN	NaN	9.9e-1	7.4e-1	1.8e+0	1.8e+0	1.7e+0	9.4e-1
997	1	25	8.6e-1	9.3e-1	9.8e-1	9.3e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	8.9e-1	1.1e+0	1.1e+0	1.1e+0	9.5e-1
997	25	1	8.7e-1	9.5e-1	1.0e+0	9.0e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.0e-1	1.1e+0	1.1e+0	1.1e+0	9.3e-1
997	50	50	1.1e+0	9.5e-1	4.0e+0	1.1e+0	1.0e+1	1.0e+1	3.6e+0	6.9e+0	7.5e+0	9.5e-1	1.0e+0	6.1e-1	6.4e+0	5.9e+0	4.3e+0	9.8e-1
997	25	50	9.1e-1	9.2e-1	2.8e+0	9.1e-1	7.3e+0	7.4e+0	NaN	NaN	NaN	NaN	1.0e+0	5.9e-1	3.8e+0	3.7e+0	3.1e+0	9.7e-1
997	50	25	8.9e-1	9.4e-1	2.9e+0	8.9e-1	7.4e+0	7.2e+0	NaN	NaN	NaN	NaN	9.9e-1	6.0e-1	3.8e+0	3.8e+0	3.1e+0	9.8e-1
997	1	50	8.6e-1	9.5e-1	1.1e+0	8.9e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	1.0e+0	8.5e-1	1.1e+0	1.1e+0	1.1e+0	9.2e-1
997	50	1	8.7e-1	9.4e-1	1.1e+0	8.8e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.8e-1	8.9e-1	1.1e+0	1.2e+0	1.1e+0	9.4e-1
997	100	100	9.3e-1	9.4e-1	1.2e+1	1.0e+0	2.7e+1	2.7e+1	9.4e+0	1.7e+1	1.7e+1	9.6e-1	1.0e+0	5.6e-1	2.1e+1	1.8e+1	7.6e+0	1.0e+0
997	50	100	9.5e-1	9.4e-1	7.9e+0	9.2e-1	2.1e+1	2.2e+1	NaN	NaN	NaN	NaN	1.0e+0	5.8e-1	1.2e+1	1.0e+1	5.9e+0	1.0e+0
997	100	50	9.4e-1	9.4e-1	7.9e+0	9.3e-1	2.1e+1	2.1e+1	NaN	NaN	NaN	NaN	1.0e+0	5.5e-1	1.2e+1	1.0e+1	5.7e+0	9.7e-1
997	1	100	8.8e-1	9.6e-1	1.1e+0	9.1e-1	1.6e+0	1.5e+0	NaN	NaN	NaN	NaN	1.0e+0	8.3e-1	1.3e+0	1.2e+0	1.2e+0	9.4e-1
997	100	1	8.9e-1	9.7e-1	1.1e+0	8.8e-1	1.6e+0	1.6e+0	NaN	NaN	NaN	NaN	9.7e-1	8.3e-1	1.3e+0	1.3e+0	1.3e+0	9.3e-1
997	250	250	1.1e+0	9.3e-1	4.0e+1	1.0e+0	6.0e+1	6.0e+1	2.9e+1	4.0e+1	3.9e+1	9.4e-1	1.0e+0	5.6e-1	6.7e+1	4.1e+1	1.0e+1	1.0e+0
997	125	250	9.9e-1	9.3e-1	3.1e+1	1.0e+0	5.5e+1	5.5e+1	NaN	NaN	NaN	NaN	1.0e+0	5.6e-1	4.6e+1	3.2e+1	9.9e+0	9.9e-1
997	250	125	1.0e+0	9.3e-1	3.0e+1	1.0e+0	5.5e+1	5.6e+1	NaN	NaN	NaN	NaN	1.0e+0	5.6e-1	4.6e+1	3.4e+1	1.0e+1	1.0e+0
997	1	250	9.1e-1	9.4e-1	1.4e+0	9.2e-1	2.4e+0	2.4e+0	NaN	NaN	NaN	NaN	1.0e+0	7.5e-1	1.6e+0	1.6e+0	1.5e+0	9.8e-1
997	250	1	8.7e-1	9.5e-1	1.4e+0	8.9e-1	2.3e+0	2.3e+0	NaN	NaN	NaN	NaN	9.8e-1	7.3e-1	1.7e+0	1.6e+0	1.6e+0	9.4e-1
997	500	500	1.0e+0	9.5e-1	6.1e+1	1.0e+0	7.1e+1	7.0e+1	4.8e+1	5.6e+1	5.4e+1	1.0e+0	1.0e+0	5.3e-1	1.0e+2	5.6e+1	1.1e+1	1.0e+0
997	250	500	1.1e+0	9.5e-1	5.4e+1	1.1e+0	6.9e+1	6.9e+1	NaN	NaN	NaN	NaN	1.1e+0	5.4e-1	8.5e+1	5.1e+1	1.1e+1	1.0e+0
997	500	250	1.1e+0	9.4e-1	5.4e+1	1.0e+0	6.8e+1	6.9e+1	NaN	NaN	NaN	NaN	1.0e+0	5.2e-1	8.4e+1	4.8e+1	1.1e+1	1.0e+0
997	1	500	9.5e-1	9.5e-1	1.8e+0	9.5e-1	3.7e+0	3.7e+0	NaN	NaN	NaN	NaN	1.1e+0	6.6e-1	2.2e+0	2.2e+0	2.0e+0	9.3e-1
997	500	1	8.7e-1	9.5e-1	1.7e+0	8.6e-1	3.5e+0	3.4e+0	NaN	NaN	NaN	NaN	9.9e-1	6.9e-1	2.3e+0	2.2e+0	2.0e+0	9.1e-1
997	1000	1000	1.1e+0	9.5e-1	6.5e+1	1.0e+0	7.0e+1	6.9e+1	5.0e+1	5.3e+1	5.2e+1	9.9e-1	1.0e+0	5.9e-1	1.0e+2	5.1e+1	7.1e+0	1.0e+0
997	500	1000	1.0e+0	9.6e-1	6.5e+1	1.1e+0	7.1e+1	7.0e+1	NaN	NaN	NaN	NaN	1.0e+0	6.1e-1	1.0e+2	5.4e+1	1.0e+1	1.0e+0
997	1000	500	1.0e+0	9.4e-1	6.7e+1	1.0e+0	7.3e+1	7.2e+1	NaN	NaN	NaN	NaN	1.1e+0	5.7e-1	1.1e+2	5.5e+1	1.0e+1	1.0e+0
997	1	1000	8.9e-1	9.4e-1	2.5e+0	9.2e-1	6.0e+0	6.0e+0	NaN	NaN	NaN	NaN	1.0e+0	6.3e-1	3.3e+0	3.2e+0	2.8e+0	9.6e-1
997	1000	1	8.6e-1	9.4e-1	2.5e+0	8.9e-1	5.2e+0	5.3e+0	NaN	NaN	NaN	NaN	9.5e-1	6.8e-1	3.4e+0	3.2e+0	2.8e+0	9.7e-1
997	2500	2500	1.0e+0	9.8e-1	9.2e+1	1.0e+0	9.4e+1	9.5e+1	3.8e+1	3.8e+1	3.8e+1	1.0e+0	1.0e+0	5.7e-1	4.1e+1	1.6e+1	5.9e+0	9.9e-1
997	1250	2500	1.2e+0	9.5e-1	4.2e+1	1.1e+0	4.4e+1	4.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.1e-1	6.5e+1	3.0e+1	6.6e+0	1.1e+0
997	2500	1250	1.2e+0	1.0e+0	4.2e+1	1.1e+0	4.2e+1	4.1e+1	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	6.4e+1	3.1e+1	6.7e+0	1.1e+0
997	1	2500	1.0e+0	1.0e+0	4.8e+0	1.1e+0	1.4e+1	1.3e+1	NaN	NaN	NaN	NaN	1.1e+0	6.4e-1	6.8e+0	6.5e+0	4.4e+0	1.0e+0
997	2500	1	1.0e+0	9.9e-1	4.3e+0	9.6e-1	9.2e+0	9.4e+0	NaN	NaN	NaN	NaN	1.0e+0	6.6e-1	6.3e+0	5.9e+0	4.4e+0	1.0e+0
997	5000	5000	1.1e+0	1.0e+0	1.5e+4	1.1e+0	2.6e+4	2.7e+4	7.0e+1	7.2e+1	7.1e+1	1.2e+0	1.1e+0	6.3e-1	3.2e+1	1.2e+1	5.9e+0	1.0e+0
997	2500	5000	1.0e+0	1.0e+0	8.9e+3	1.0e+0	1.7e+4	1.7e+4	NaN	NaN	NaN	NaN	1.1e+0	6.1e-1	2.9e+1	1.1e+1	5.8e+0	1.0e+0
997	5000	2500	1.0e+0	1.0e+0	8.6e+3	1.1e+0	1.6e+4	1.6e+4	NaN	NaN	NaN	NaN	1.1e+0	6.7e-1	3.1e+1	1.1e+1	5.9e+0	1.0e+0
997	1	5000	1.0e+0	1.0e+0	8.2e+0	9.4e-1	2.2e+1	2.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.3e-1	1.2e+1	1.1e+1	6.1e+0	1.0e+0
997	5000	1	9.6e-1	1.0e+0	6.6e+0	9.7e-1	1.2e+1	1.3e+1	NaN	NaN	NaN	NaN	1.0e+0	6.7e-1	9.8e+0	9.4e+0	5.8e+0	1.0e+0
997	10000	10000	1.0e+0	1.0e+0	5.0e+4	1.0e+0	7.6e+4	7.5e+4	1.4e+2	1.4e+2	1.5e+2	1.1e+0	1.1e+0	6.4e-1	3.4e+1	1.3e+1	6.3e+0	1.0e+0
997	5000	10000	1.1e+0	1.0e+0	3.2e+4	1.1e+0	5.6e+4	5.7e+4	NaN	NaN	NaN	NaN	1.1e+0	6.3e-1	3.3e+1	1.3e+1	6.0e+0	1.0e+0
997	10000	5000	1.0e+0	1.0e+0	2.7e+4	1.1e+0	4.6e+4	4.5e+4	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	3.3e+1	1.2e+1	6.0e+0	1.0e+0
997	1	10000	9.8e-1	1.0e+0	1.4e+1	1.0e+0	3.3e+1	3.3e+1	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	2.1e+1	1.8e+1	7.6e+0	9.9e-1
997	10000	1	9.8e-1	1.0e+0	9.5e+0	1.0e+0	1.5e+1	1.5e+1	NaN	NaN	NaN	NaN	1.0e+0	6.4e-1	1.4e+1	1.3e+1	7.2e+0	1.0e+0

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
1000	5	5	9.7e-1	9.8e-1	1.0e+0	9.7e-1	1.2e+0	1.2e+0	1.0e+0	1.1e+0	1.1e+0	9.7e-1	1.0e+0	9.2e-1	1.1e+0	1.1e+0	1.1e+0	9.7e-1
1000	2	5	9.8e-1	1.0e+0	1.0e+0	1.0e+0	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.8e-1	9.6e-1	1.1e+0	1.1e+0	1.1e+0	9.6e-1
1000	5	2	1.0e+0	9.8e-1	1.1e+0	1.0e+0	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.5e-1	1.1e+0	1.1e+0	1.1e+0	9.6e-1
1000	1	5	9.7e-1	1.1e+0	1.0e+0	1.0e+0	1.1e+0	1.0e+0	NaN	NaN	NaN	NaN	9.9e-1	9.3e-1	1.1e+0	1.1e+0	1.1e+0	9.5e-1
1000	5	1	9.7e-1	1.0e+0	1.1e+0	1.0e+0	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.5e-1	1.0e+0	1.1e+0	1.0e+0	9.5e-1
1000	10	10	9.9e-1	9.7e-1	1.1e+0	1.0e+0	1.5e+0	1.5e+0	1.1e+0	1.3e+0	1.3e+0	1.0e+0	1.1e+0	8.4e-1	1.3e+0	1.3e+0	1.3e+0	9.9e-1
1000	5	10	9.7e-1	9.8e-1	1.1e+0	9.9e-1	1.4e+0	1.4e+0	NaN	NaN	NaN	NaN	1.1e+0	8.6e-1	1.2e+0	1.2e+0	1.1e+0	1.0e+0
1000	10	5	9.7e-1	9.7e-1	1.1e+0	1.0e+0	1.4e+0	1.4e+0	NaN	NaN	NaN	NaN	1.0e+0	8.7e-1	1.2e+0	1.2e+0	1.2e+0	9.9e-1
1000	1	10	9.7e-1	9.8e-1	1.0e+0	1.0e+0	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.8e-1	1.0e+0	1.1e+0	1.1e+0	9.9e-1
1000	10	1	9.7e-1	9.8e-1	1.1e+0	9.9e-1	1.2e+0	1.2e+0	NaN	NaN	NaN	NaN	9.7e-1	9.5e-1	1.1e+0	1.1e+0	1.0e+0	1.0e+0
1000	25	25	1.0e+0	1.0e+0	2.0e+0	1.0e+0	4.0e+0	4.0e+0	1.9e+0	3.1e+0	3.4e+0	1.0e+0	1.1e+0	7.1e-1	2.6e+0	2.5e+0	2.4e+0	9.7e-1
1000	12	25	9.6e-1	1.0e+0	1.6e+0	1.0e+0	3.0e+0	3.0e+0	NaN	NaN	NaN	NaN	1.1e+0	7.6e-1	1.9e+0	1.8e+0	1.7e+0	1.0e+0
1000	25	12	9.9e-1	9.9e-1	1.6e+0	1.0e+0	3.0e+0	3.0e+0	NaN	NaN	NaN	NaN	1.1e+0	7.8e-1	1.9e+0	1.9e+0	1.7e+0	1.0e+0
1000	1	25	9.8e-1	9.6e-1	1.1e+0	1.0e+0	1.2e+0	1.2e+0	NaN	NaN	NaN	NaN	1.0e+0	9.2e-1	1.1e+0	1.1e+0	1.1e+0	9.7e-1
1000	25	1	1.0e+0	9.9e-1	1.1e+0	1.0e+0	1.2e+0	1.2e+0	NaN	NaN	NaN	NaN	9.9e-1	9.3e-1	1.1e+0	1.1e+0	1.1e+0	9.9e-1
1000	50	50	1.0e+0	1.1e+0	4.5e+0	1.1e+0	1.0e+1	1.1e+1	3.9e+0	7.2e+0	7.8e+0	9.7e-1	1.1e+0	6.3e-1	7.2e+0	6.8e+0	4.8e+0	9.4e-1
1000	25	50	9.3e-1	1.0e+0	3.1e+0	9.6e-1	8.0e+0	8.0e+0	NaN	NaN	NaN	NaN	1.1e+0	6.8e-1	4.3e+0	4.2e+0	3.4e+0	1.0e+0
1000	50	25	9.3e-1	1.0e+0	3.1e+0	9.8e-1	8.0e+0	7.8e+0	NaN	NaN	NaN	NaN	1.1e+0	6.9e-1	4.2e+0	4.2e+0	3.2e+0	1.0e+0
1000	1	50	9.7e-1	9.9e-1	1.1e+0	9.9e-1	1.4e+0	1.4e+0	NaN	NaN	NaN	NaN	1.0e+0	8.6e-1	1.1e+0	1.2e+0	1.2e+0	9.7e-1
1000	50	1	1.0e+0	9.8e-1	1.1e+0	1.0e+0	1.4e+0	1.4e+0	NaN	NaN	NaN	NaN	9.8e-1	9.1e-1	1.2e+0	1.2e+0	1.2e+0	9.4e-1
1000	100	100	1.0e+0	1.0e+0	1.4e+1	1.0e+0	3.0e+1	2.9e+1	1.0e+1	1.7e+1	1.8e+1	1.0e+0	1.1e+0	5.8e-1	2.2e+1	1.8e+1	8.0e+0	1.0e+0
1000	50	100	9.2e-1	1.0e+0	8.4e+0	9.1e-1	2.2e+1	2.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	1.2e+1	1.1e+1	6.1e+0	9.6e-1
1000	100	50	9.5e-1	1.0e+0	8.3e+0	9.0e-1	2.1e+1	2.1e+1	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	1.3e+1	1.1e+1	6.4e+0	9.7e-1
1000	1	100	9.7e-1	9.7e-1	1.2e+0	9.8e-1	1.7e+0	1.7e+0	NaN	NaN	NaN	NaN	1.1e+0	8.6e-1	1.3e+0	1.3e+0	1.2e+0	9.8e-1
1000	100	1	9.8e-1	1.0e+0	1.2e+0	9.9e-1	1.8e+0	1.7e+0	NaN	NaN	NaN	NaN	1.0e+0	8.9e-1	1.3e+0	1.3e+0	1.3e+0	1.0e+0
1000	250	250	1.0e+0	1.0e+0	4.2e+1	9.9e-1	6.1e+1	6.1e+1	2.9e+1	4.0e+1	3.9e+1	1.0e+0	1.1e+0	5.8e-1	7.0e+1	4.4e+1	1.1e+1	1.0e+0
1000	125	250	1.0e+0	1.0e+0	3.2e+1	1.0e+0	5.5e+1	5.5e+1	NaN	NaN	NaN	NaN	1.1e+0	5.9e-1	4.8e+1	3.4e+1	1.1e+1	9.8e-1
1000	250	125	1.0e+0	1.0e+0	3.1e+1	1.0e+0	5.5e+1	5.4e+1	NaN	NaN	NaN	NaN	1.1e+0	5.8e-1	4.6e+1	3.3e+1	1.0e+1	9.9e-1
1000	1	250	9.9e-1	1.0e+0	1.4e+0	1.0e+0	2.6e+0	2.5e+0	NaN	NaN	NaN	NaN	1.1e+0	7.7e-1	1.7e+0	1.7e+0	1.6e+0	9.6e-1
1000	250	1	9.6e-1	1.0e+0	1.5e+0	1.0e+0	2.6e+0	2.5e+0	NaN	NaN	NaN	NaN	1.0e+0	7.9e-1	1.7e+0	1.7e+0	1.6e+0	1.0e+0
1000	500	500	1.0e+0	1.0e+0	6.2e+1	1.0e+0	7.0e+1	7.0e+1	4.7e+1	5.3e+1	5.2e+1	9.8e-1	1.2e+0	5.6e-1	9.9e+1	5.4e+1	1.1e+1	1.0e+0
1000	250	500	1.0e+0	1.0e+0	5.3e+1	1.0e+0	6.5e+1	6.6e+1	NaN	NaN	NaN	NaN	1.1e+0	5.5e-1	8.5e+1	4.9e+1	1.1e+1	1.0e+0
1000	500	250	1.0e+0	1.0e+0	5.3e+1	1.0e+0	6.6e+1	6.6e+1	NaN	NaN	NaN	NaN	1.1e+0	5.9e-1	8.5e+1	4.8e+1	1.1e+1	1.0e+0
1000	1	500	9.6e-1	9.9e-1	1.9e+0	1.0e+0	4.0e+0	3.9e+0	NaN	NaN	NaN	NaN	1.1e+0	7.0e-1	2.3e+0	2.3e+0	2.1e+0	9.5e-1
1000	500	1	1.0e+0	9.9e-1	1.9e+0	1.0e+0	4.0e+0	4.0e+0	NaN	NaN	NaN	NaN	1.0e+0	7.7e-1	2.3e+0	2.3e+0	2.1e+0	9.5e-1
1000	1000	1000	1.0e+0	1.0e+0	6.3e+1	9.6e-1	6.7e+1	6.7e+1	5.5e+1	5.8e+1	5.8e+1	9.7e-1	1.1e+0	6.3e-1	1.0e+2	4.8e+1	7.1e+0	1.0e+0
1000	500	1000	1.0e+0	1.0e+0	6.5e+1	1.1e+0	7.0e+1	7.0e+1	NaN	NaN	NaN	NaN	1.1e+0	6.4e-1	1.1e+2	5.7e+1	1.1e+1	1.0e+0
1000	1000	500	1.0e+0	1.0e+0	6.5e+1	1.0e+0	7.1e+1	6.9e+1	NaN	NaN	NaN	NaN	1.1e+0	6.6e-1	1.1e+2	5.9e+1	1.1e+1	9.9e-1
1000	1	1000	8.8e-1	9.9e-1	2.6e+0	8.9e-1	6.5e+0	6.5e+0	NaN	NaN	NaN	NaN	1.1e+0	6.8e-1	3.5e+0	3.4e+0	2.9e+0	9.6e-1
1000	1000	1	1.0e+0	1.0e+0	2.7e+0	9.9e-1	6.0e+0	6.1e+0	NaN	NaN	NaN	NaN	1.0e+0	7.2e-1	3.5e+0	3.5e+0	3.0e+0	9.7e-1
1000	2500	2500	1.7e+0	1.1e+0	1.0e+2	1.7e+0	1.0e+2	1.0e+2	3.8e+1	3.9e+1	3.9e+1	9.9e-1	1.1e+0	6.7e-1	4.2e+1	1.6e+1	6.5e+0	9.5e-1
1000	1250	2500	1.0e+0	9.9e-1	4.1e+1	1.0e+0	4.2e+1	4.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.1e-1	6.7e+1	3.2e+1	6.7e+0	1.0e+0
1000	2500	1250	1.0e+0	1.0e+0	4.2e+1	1.0e+0	4.3e+1	4.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	6.7e+1	3.0e+1	6.7e+0	9.8e-1
1000	1	2500	9.9e-1	9.9e-1	5.0e+0	9.7e-1	1.4e+1	1.3e+1	NaN	NaN	NaN	NaN	1.1e+0	6.1e-1	7.2e+0	6.7e+0	4.5e+0	1.0e+0
1000	2500	1	9.8e-1	1.0e+0	4.7e+0	1.0e+0	9.9e+0	9.8e+0	NaN	NaN	NaN	NaN	1.0e+0	6.8e-1	6.5e+0	6.1e+0	4.4e+0	1.0e+0
1000	5000	5000	1.0e+0	1.0e+0	1.4e+4	1.1e+0	2.4e+4	2.3e+4	6.9e+1	6.7e+1	7.0e+1	1.1e+0	1.1e+0	6.0e-1	3.2e+1	1.2e+1	5.9e+0	1.0e+0
1000	2500	5000	9.9e-1	1.0e+0	9.4e+3	1.0e+0	1.7e+4	1.7e+4	NaN	NaN	NaN	NaN	1.1e+0	6.1e-1	3.0e+1	1.1e+1	5.6e+0	1.0e+0
1000	5000	2500	1.0e+0	1.0e+0	8.9e+3	1.1e+0	1.6e+4	1.6e+4	NaN	NaN	NaN	NaN	1.1e+0	6.4e-1	3.2e+1	1.1e+1	5.6e+0	1.0e+0
1000	1	5000	9.9e-1	1.0e+0	8.5e+0	9.8e-1	2.1e+1	2.1e+1	NaN	NaN	NaN	NaN	1.1e+0	6.5e-1	1.3e+1	1.1e+1	6.2e+0	9.9e-1
1000	5000	1	1.1e+0	1.0e+0	6.9e+0	1.0e+0	1.3e+1	1.3e+1	NaN	NaN	NaN	NaN	1.0e+0	6.6e-1	1.0e+1	9.5e+0	5.8e+0	1.0e+0
1000	10000	10000	1.0e+0	1.0e+0	5.2e+4	1.1e+0	7.6e+4	7.4e+4	1.4e+2	1.3e+2	1.3e+2	1.0e+0	1.0e+0	6.1e-1	3.4e+1	1.3e+1	6.3e+0	1.0e+0
1000	5000	10000	1.0e+0	1.0e+0	3.3e+4	1.1e+0	5.8e+4	5.7e+4	NaN	NaN	NaN	NaN	1.1e+0	6.3e-1	3.3e+1	1.2e+1	6.0e+0	1.0e+0
1000	10000	5000	1.0e+0	1.0e+0	2.9e+4	1.1e+0	4.7e+4	4.5e+4	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	3.2e+1	1.3e+1	6.1e+0	1.0e+0
1000	1	10000	9.1e-1	1.0e+0	1.4e+1	1.0e+0	3.3e+1	3.1e+1	NaN	NaN	NaN	NaN	1.1e+0	6.5e-1	2.1e+1	1.8e+1	7.8e+0	1.0e+0
1000	10000	1	1.0e+0	1.0e+0	1.0e+1	1.0e+0	1.6e+1	1.5e+1	NaN	NaN	NaN	NaN	1.1e+0	6.5e-1	1.5e+1	1.4e+1	7.3e+0	1.0e+0

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
9001	5	5	9.9e-1	9.5e-1	1.1e+0	9.9e-1	1.1e+0	1.2e+0	9.8e-1	1.1e+0	1.0e+0	1.0e+0	1.1e+0	9.0e-1	1.1e+0	1.1e+0	1.1e+0	9.4e-1
9001	2	5	9.6e-1	9.3e-1	1.0e+0	9.6e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.3e-1	1.1e+0	1.0e+0	1.1e+0	9.7e-1
9001	5	2	9.5e-1	9.5e-1	1.0e+0	1.0e+0	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.9e-1	9.4e-1	1.0e+0	1.1e+0	1.0e+0	9.6e-1
9001	1	5	9.6e-1	9.6e-1	1.0e+0	9.7e-1	1.1e+0	1.0e+0	NaN	NaN	NaN	NaN	1.0e+0	9.7e-1	1.1e+0	1.0e+0	1.1e+0	9.8e-1
9001	5	1	9.7e-1	9.7e-1	1.0e+0	1.0e+0	1.0e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.6e-1	1.1e+0	1.1e+0	1.0e+0	9.8e-1
9001	10	10	9.5e-1	9.5e-1	1.2e+0	1.0e+0	1.5e+0	1.5e+0	1.1e+0	1.3e+0	1.3e+0	9.8e-1	1.1e+0	8.5e-1	1.3e+0	1.3e+0	1.2e+0	9.6e-1
9001	5	10	9.6e-1	9.4e-1	1.1e+0	9.8e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	1.1e+0	8.9e-1	1.1e+0	1.1e+0	1.1e+0	9.7e-1
9001	10	5	9.5e-1	9.9e-1	1.1e+0	9.9e-1	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	1.1e+0	8.8e-1	1.1e+0	1.1e+0	1.1e+0	9.7e-1
9001	1	10	9.5e-1	9.5e-1	1.0e+0	9.5e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.2e-1	1.1e+0	1.0e+0	1.1e+0	9.6e-1
9001	10	1	9.3e-1	9.5e-1	1.0e+0	9.8e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.6e-1	1.1e+0	1.1e+0	1.1e+0	9.8e-1
9001	25	25	9.6e-1	9.9e-1	1.9e+0	9.5e-1	3.8e+0	3.7e+0	1.8e+0	3.0e+0	3.1e+0	9.9e-1	1.0e+0	6.9e-1	2.6e+0	2.6e+0	2.3e+0	1.0e+0
9001	12	25	9.5e-1	9.8e-1	1.5e+0	9.7e-1	2.7e+0	2.8e+0	NaN	NaN	NaN	NaN	1.1e+0	7.5e-1	1.8e+0	1.8e+0	1.7e+0	9.5e-1
9001	25	12	1.0e+0	9.8e-1	1.5e+0	1.0e+0	3.0e+0	3.0e+0	NaN	NaN	NaN	NaN	1.1e+0	7.8e-1	1.8e+0	1.8e+0	1.7e+0	1.0e+0
9001	1	25	9.6e-1	9.9e-1	1.0e+0	9.8e-1	1.2e+0	1.2e+0	NaN	NaN	NaN	NaN	1.0e+0	8.9e-1	1.1e+0	1.1e+0	1.1e+0	9.4e-1
9001	25	1	1.0e+0	9.7e-1	1.1e+0	9.7e-1	1.2e+0	1.2e+0	NaN	NaN	NaN	NaN	1.0e+0	9.0e-1	1.1e+0	1.1e+0	1.1e+0	9.7e-1
9001	50	50	9.9e-1	1.0e+0	4.2e+0	1.1e+0	1.0e+1	1.0e+1	3.8e+0	7.5e+0	7.9e+0	9.9e-1	1.1e+0	6.3e-1	6.7e+0	6.4e+0	4.5e+0	1.0e+0
9001	25	50	9.8e-1	1.0e+0	2.9e+0	9.8e-1	7.8e+0	7.9e+0	NaN	NaN	NaN	NaN	1.1e+0	6.7e-1	4.0e+0	3.9e+0	3.1e+0	9.9e-1
9001	50	25	9.8e-1	9.9e-1	3.0e+0	9.6e-1	8.0e+0	7.8e+0	NaN	NaN	NaN	NaN	1.1e+0	6.9e-1	4.0e+0	3.9e+0	3.1e+0	1.0e+0
9001	1	50	9.5e-1	9.5e-1	1.1e+0	9.8e-1	1.3e+0	1.4e+0	NaN	NaN	NaN	NaN	1.0e+0	8.3e-1	1.1e+0	1.1e+0	1.1e+0	9.9e-1
9001	50	1	9.1e-1	9.7e-1	1.1e+0	9.5e-1	1.4e+0	1.4e+0	NaN	NaN	NaN	NaN	1.0e+0	9.0e-1	1.2e+0	1.2e+0	1.2e+0	1.0e+0
9001	100	100	1.0e+0	1.0e+0	1.3e+1	9.4e-1	2.8e+1	2.9e+1	9.9e+0	1.8e+1	1.8e+1	9.9e-1	1.1e+0	6.0e-1	2.0e+1	1.7e+1	7.5e+0	9.7e-1
9001	50	100	9.0e-1	1.0e+0	8.0e+0	1.0e+0	2.0e+1	2.2e+1	NaN	NaN	NaN	NaN	1.1e+0	5.8e-1	1.2e+1	1.0e+1	6.0e+0	9.6e-1
9001	100	50	9.4e-1	1.0e+0	8.0e+0	1.0e+0	2.0e+1	2.1e+1	NaN	NaN	NaN	NaN	1.1e+0	5.8e-1	1.2e+1	1.0e+1	6.1e+0	9.9e-1
9001	1	100	9.4e-1	9.9e-1	1.2e+0	9.8e-1	1.6e+0	1.6e+0	NaN	NaN	NaN	NaN	1.1e+0	8.3e-1	1.3e+0	1.3e+0	1.2e+0	9.7e-1
9001	100	1	1.0e+0	9.7e-1	1.2e+0	9.8e-1	1.7e+0	1.7e+0	NaN	NaN	NaN	NaN	1.1e+0	8.2e-1	1.3e+0	1.3e+0	1.2e+0	9.9e-1
9001	250	250	1.0e+0	1.0e+0	4.2e+1	1.0e+0	5.9e+1	6.0e+1	3.0e+1	3.9e+1	3.9e+1	1.0e+0	1.1e+0	5.3e-1	6.6e+1	4.0e+1	1.1e+1	1.0e+0
9001	125	250	1.0e+0	1.0e+0	2.9e+1	9.9e-1	5.2e+1	5.2e+1	NaN	NaN	NaN	NaN	1.1e+0	5.4e-1	4.5e+1	3.2e+1	1.0e+1	1.0e+0
9001	250	125	1.0e+0	1.0e+0	2.9e+1	9.7e-1	5.1e+1	5.1e+1	NaN	NaN	NaN	NaN	1.1e+0	5.5e-1	4.5e+1	3.1e+1	1.0e+1	1.0e+0
9001	1	250	9.6e-1	9.9e-1	1.4e+0	9.9e-1	2.6e+0	2.5e+0	NaN	NaN	NaN	NaN	1.1e+0	8.2e-1	1.7e+0	1.6e+0	1.6e+0	9.8e-1
9001	250	1	9.6e-1	9.6e-1	1.5e+0	9.6e-1	2.5e+0	2.6e+0	NaN	NaN	NaN	NaN	1.0e+0	8.3e-1	1.7e+0	1.7e+0	1.6e+0	1.0e+0
9001	500	500	9.8e-1	1.0e+0	6.3e+1	1.0e+0	6.7e+1	7.0e+1	4.8e+1	5.4e+1	5.2e+1	1.0e+0	1.1e+0	5.7e-1	9.9e+1	5.2e+1	1.2e+1	1.0e+0
9001	250	500	9.9e-1	1.0e+0	5.3e+1	9.9e-1	6.8e+1	6.6e+1	NaN	NaN	NaN	NaN	1.1e+0	5.4e-1	8.4e+1	4.6e+1	1.1e+1	9.9e-1
9001	500	250	9.9e-1	1.0e+0	5.2e+1	9.8e-1	6.7e+1	6.6e+1	NaN	NaN	NaN	NaN	1.1e+0	5.3e-1	8.4e+1	4.8e+1	1.1e+1	1.0e+0
9001	1	500	9.4e-1	9.9e-1	1.8e+0	9.7e-1	3.8e+0	3.9e+0	NaN	NaN	NaN	NaN	1.1e+0	7.1e-1	2.3e+0	2.2e+0	2.1e+0	9.7e-1
9001	500	1	1.0e+0	1.0e+0	1.9e+0	9.8e-1	3.8e+0	3.8e+0	NaN	NaN	NaN	NaN	1.1e+0	7.4e-1	2.2e+0	2.2e+0	2.1e+0	9.9e-1
9001	1000	1000	1.0e+0	1.0e+0	6.4e+1	1.0e+0	6.5e+1	6.6e+1	5.8e+1	5.7e+1	5.9e+1	9.6e-1	1.1e+0	6.1e-1	1.1e+2	4.8e+1	6.7e+0	1.0e+0
9001	500	1000	9.9e-1	1.0e+0	6.5e+1	1.0e+0	7.1e+1	7.0e+1	NaN	NaN	NaN	NaN	1.1e+0	5.9e-1	1.1e+2	5.6e+1	1.1e+1	1.1e+0
9001	1000	500	9.9e-1	1.0e+0	6.6e+1	1.0e+0	7.1e+1	7.0e+1	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	1.1e+2	5.5e+1	1.1e+1	1.0e+0
9001	1	1000	9.2e-1	9.8e-1	2.5e+0	9.6e-1	6.3e+0	6.4e+0	NaN	NaN	NaN	NaN	1.1e+0	6.4e-1	3.3e+0	3.3e+0	2.7e+0	9.7e-1
9001	1000	1	9.5e-1	9.9e-1	2.6e+0	9.8e-1	5.8e+0	5.8e+0	NaN	NaN	NaN	NaN	1.1e+0	6.6e-1	3.3e+0	3.3e+0	2.7e+0	9.7e-1
9001	2500	2500	1.0e+0	1.0e+0	9.4e+1	1.0e+0	9.4e+1	9.0e+1	3.9e+1	3.8e+1	3.8e+1	1.1e+0	1.1e+0	5.8e-1	4.1e+1	1.6e+1	5.8e+0	1.0e+0
9001	1250	2500	1.0e+0	1.0e+0	4.1e+1	1.1e+0	4.2e+1	4.2e+1	NaN	NaN	NaN	NaN	1.1e+0	5.6e-1	6.6e+1	3.2e+1	6.6e+0	1.0e+0
9001	2500	1250	9.7e-1	9.9e-1	4.1e+1	1.1e+0	4.3e+1	4.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.1e-1	6.6e+1	3.1e+1	6.7e+0	1.1e+0
9001	1	2500	1.1e+0	1.0e+0	4.6e+0	1.0e+0	1.3e+1	1.3e+1	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	6.6e+0	6.5e+0	4.6e+0	1.0e+0
9001	2500	1	1.0e+0	1.0e+0	4.4e+0	9.7e-1	9.4e+0	9.4e+0	NaN	NaN	NaN	NaN	1.0e+0	6.2e-1	6.3e+0	5.9e+0	4.3e+0	9.9e-1
9001	5000	5000	1.0e+0	1.0e+0	1.4e+4	1.1e+0	2.4e+4	2.4e+4	7.3e+1	6.8e+1	6.9e+1	1.1e+0	1.1e+0	5.5e-1	3.2e+1	1.2e+1	6.0e+0	1.0e+0
9001	2500	5000	1.0e+0	1.0e+0	8.8e+3	1.1e+0	1.7e+4	1.7e+4	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	2.9e+1	1.1e+1	5.6e+0	1.0e+0
9001	5000	2500	9.9e-1	1.0e+0	7.9e+3	1.1e+0	1.4e+4	1.4e+4	NaN	NaN	NaN	NaN	1.1e+0	5.9e-1	3.0e+1	1.1e+1	5.5e+0	1.0e+0
9001	1	5000	9.4e-1	1.0e+0	7.9e+0	9.8e-1	2.2e+1	2.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.7e-1	1.2e+1	1.0e+1	6.3e+0	1.0e+0
9001	5000	1	9.6e-1	9.8e-1	6.6e+0	9.4e-1	1.3e+1	1.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.4e-1	9.7e+0	9.1e+0	5.8e+0	9.9e-1
9001	10000	10000	9.9e-1	1.0e+0	5.1e+4	1.1e+0	7.6e+4	7.4e+4	1.4e+2	1.4e+2	1.4e+2	1.1e+0	1.1e+0	6.3e-1	3.4e+1	1.3e+1	6.3e+0	1.0e+0
9001	5000	10000	1.0e+0	1.0e+0	3.3e+4	1.1e+0	5.8e+4	5.6e+4	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	3.4e+1	1.2e+1	6.0e+0	1.0e+0
9001	10000	5000	1.0e+0	1.0e+0	2.8e+4	1.1e+0	4.6e+4	4.6e+4	NaN	NaN	NaN	NaN	1.1e+0	5.9e-1	3.3e+1	1.2e+1	5.9e+0	9.9e-1
9001	1	10000	1.0e+0	1.0e+0	1.4e+1	9.7e-1	3.3e+1	3.3e+1	NaN	NaN	NaN	NaN	1.1e+0	5.9e-1	2.0e+1	1.7e+1	7.9e+0	9.9e-1
9001	10000	1	9.9e-1	1.0e+0	9.7e+0	9.9e-1	1.5e+1	1.5e+1	NaN	NaN	NaN	NaN	1.0e+0	6.3e-1	1.5e+1	1.3e+1	7.2e+0	1.0e+0

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
10000	5	5	9.6e-1	9.9e-1	1.0e+0	9.9e-1	1.2e+0	1.2e+0	1.0e+0	1.1e+0	1.1e+0	9.9e-1	9.9e-1	9.1e-1	1.1e+0	1.1e+0	1.1e+0	9.9e-1
10000	2	5	9.6e-1	9.9e-1	1.0e+0	9.8e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	8.9e-1	1.1e+0	1.1e+0	1.1e+0	9.8e-1
10000	5	2	9.6e-1	9.9e-1	1.0e+0	9.8e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.9e-1	9.8e-1	1.1e+0	1.1e+0	1.1e+0	9.7e-1
10000	1	5	9.7e-1	9.9e-1	1.0e+0	1.0e+0	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.9e-1	9.4e-1	1.1e+0	1.1e+0	1.1e+0	9.7e-1
10000	5	1	9.8e-1	9.6e-1	1.0e+0	1.0e+0	1.0e+0	1.1e+0	NaN	NaN	NaN	NaN	9.9e-1	9.3e-1	1.0e+0	1.1e+0	1.0e+0	9.5e-1
10000	10	10	9.7e-1	9.9e-1	1.2e+0	9.9e-1	1.5e+0	1.5e+0	1.1e+0	1.3e+0	1.4e+0	1.0e+0	1.0e+0	8.8e-1	1.3e+0	1.3e+0	1.3e+0	9.4e-1
10000	5	10	9.8e-1	9.7e-1	1.1e+0	9.9e-1	1.4e+0	1.4e+0	NaN	NaN	NaN	NaN	1.0e+0	8.8e-1	1.2e+0	1.1e+0	1.1e+0	9.5e-1
10000	10	5	9.6e-1	1.0e+0	1.1e+0	1.0e+0	1.4e+0	1.4e+0	NaN	NaN	NaN	NaN	1.0e+0	8.6e-1	1.2e+0	1.2e+0	1.2e+0	9.8e-1
10000	1	10	9.6e-1	9.9e-1	1.0e+0	9.7e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.3e-1	1.1e+0	1.1e+0	1.1e+0	9.9e-1
10000	10	1	9.8e-1	9.9e-1	1.0e+0	9.8e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.5e-1	1.0e+0	1.1e+0	1.1e+0	1.0e+0
10000	25	25	9.9e-1	9.8e-1	2.0e+0	9.8e-1	3.7e+0	3.8e+0	1.8e+0	2.9e+0	3.1e+0	9.8e-1	1.1e+0	6.9e-1	2.7e+0	2.6e+0	2.3e+0	9.5e-1
10000	12	25	9.9e-1	9.9e-1	1.5e+0	1.0e+0	3.0e+0	2.9e+0	NaN	NaN	NaN	NaN	1.0e+0	7.6e-1	1.8e+0	1.8e+0	1.7e+0	9.5e-1
10000	25	12	9.8e-1	9.7e-1	1.5e+0	1.0e+0	3.0e+0	3.0e+0	NaN	NaN	NaN	NaN	1.1e+0	7.7e-1	1.9e+0	1.8e+0	1.7e+0	9.7e-1
10000	1	25	9.7e-1	9.9e-1	1.0e+0	9.8e-1	1.2e+0	1.2e+0	NaN	NaN	NaN	NaN	1.0e+0	9.0e-1	1.1e+0	1.0e+0	1.1e+0	9.5e-1
10000	25	1	1.0e+0	9.9e-1	1.0e+0	9.9e-1	1.2e+0	1.2e+0	NaN	NaN	NaN	NaN	9.8e-1	9.1e-1	1.1e+0	1.1e+0	1.1e+0	9.9e-1
10000	50	50	9.9e-1	1.0e+0	4.6e+0	1.0e+0	9.8e+0	9.9e+0	3.8e+0	6.8e+0	7.2e+0	9.8e-1	1.1e+0	6.0e-1	6.8e+0	6.7e+0	4.6e+0	9.6e-1
10000	25	50	9.4e-1	9.9e-1	3.1e+0	1.0e+0	7.5e+0	7.6e+0	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	4.2e+0	4.0e+0	3.2e+0	9.9e-1
10000	50	25	9.4e-1	1.0e+0	3.0e+0	9.7e-1	7.6e+0	7.8e+0	NaN	NaN	NaN	NaN	1.1e+0	6.6e-1	4.2e+0	4.0e+0	3.3e+0	1.0e+0
10000	1	50	9.8e-1	1.0e+0	1.1e+0	1.0e+0	1.4e+0	1.3e+0	NaN	NaN	NaN	NaN	1.0e+0	8.6e-1	1.1e+0	1.2e+0	1.1e+0	9.7e-1
10000	50	1	9.7e-1	9.8e-1	1.1e+0	9.7e-1	1.4e+0	1.4e+0	NaN	NaN	NaN	NaN	1.0e+0	8.7e-1	1.1e+0	1.2e+0	1.1e+0	9.7e-1
10000	100	100	9.4e-1	1.0e+0	1.3e+1	1.0e+0	2.8e+1	2.8e+1	1.0e+1	1.7e+1	1.8e+1	1.0e+0	1.1e+0	5.6e-1	2.1e+1	1.8e+1	7.6e+0	1.0e+0
10000	50	100	9.7e-1	1.0e+0	8.5e+0	9.7e-1	2.2e+1	2.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.1e-1	1.3e+1	1.2e+1	6.3e+0	1.0e+0
10000	100	50	1.0e+0	1.0e+0	8.6e+0	1.0e+0	2.2e+1	2.2e+1	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	1.3e+1	1.1e+1	6.8e+0	1.0e+0
10000	1	100	9.5e-1	9.7e-1	1.2e+0	9.9e-1	1.7e+0	1.7e+0	NaN	NaN	NaN	NaN	1.1e+0	7.9e-1	1.3e+0	1.3e+0	1.2e+0	9.6e-1
10000	100	1	9.5e-1	1.0e+0	1.2e+0	9.6e-1	1.7e+0	1.7e+0	NaN	NaN	NaN	NaN	1.0e+0	8.5e-1	1.3e+0	1.3e+0	1.3e+0	1.0e+0
10000	250	250	1.0e+0	1.0e+0	4.2e+1	9.7e-1	6.0e+1	5.9e+1	3.0e+1	3.9e+1	3.9e+1	1.0e+0	1.1e+0	5.5e-1	6.9e+1	4.1e+1	1.1e+1	1.0e+0
10000	125	250	1.0e+0	9.9e-1	3.1e+1	1.0e+0	5.4e+1	5.4e+1	NaN	NaN	NaN	NaN	1.1e+0	5.7e-1	5.1e+1	3.6e+1	1.0e+1	9.9e-1
10000	250	125	9.9e-1	1.0e+0	3.0e+1	1.0e+0	5.3e+1	5.2e+1	NaN	NaN	NaN	NaN	1.1e+0	5.7e-1	4.8e+1	3.4e+1	1.0e+1	1.0e+0
10000	1	250	9.8e-1	9.8e-1	1.5e+0	1.0e+0	2.6e+0	2.7e+0	NaN	NaN	NaN	NaN	1.1e+0	7.7e-1	1.7e+0	1.7e+0	1.6e+0	9.9e-1
10000	250	1	1.0e+0	1.0e+0	1.5e+0	1.0e+0	2.7e+0	2.7e+0	NaN	NaN	NaN	NaN	1.0e+0	8.0e-1	1.8e+0	1.7e+0	1.7e+0	1.0e+0
10000	500	500	1.0e+0	1.0e+0	6.2e+1	9.5e-1	6.8e+1	6.8e+1	4.7e+1	5.3e+1	5.3e+1	1.0e+0	1.1e+0	5.4e-1	1.0e+2	5.2e+1	1.2e+1	9.8e-1
10000	250	500	1.0e+0	9.9e-1	5.4e+1	1.0e+0	6.6e+1	6.6e+1	NaN	NaN	NaN	NaN	1.1e+0	5.3e-1	8.7e+1	4.7e+1	1.1e+1	1.0e+0
10000	500	250	1.0e+0	1.0e+0	5.5e+1	1.0e+0	6.6e+1	6.6e+1	NaN	NaN	NaN	NaN	1.1e+0	5.2e-1	8.5e+1	4.8e+1	1.1e+1	1.0e+0
10000	1	500	8.9e-1	1.0e+0	1.8e+0	9.1e-1	3.8e+0	3.8e+0	NaN	NaN	NaN	NaN	1.1e+0	6.8e-1	2.3e+0	2.2e+0	2.0e+0	9.8e-1
10000	500	1	9.2e-1	9.9e-1	2.0e+0	8.9e-1	3.7e+0	3.8e+0	NaN	NaN	NaN	NaN	1.0e+0	7.1e-1	2.3e+0	2.3e+0	2.1e+0	9.4e-1
10000	1000	1000	1.0e+0	1.0e+0	6.6e+1	9.9e-1	6.6e+1	6.6e+1	5.6e+1	5.8e+1	5.8e+1	9.9e-1	1.1e+0	6.2e-1	1.0e+2	4.7e+1	6.5e+0	1.0e+0
10000	500	1000	9.8e-1	1.0e+0	6.6e+1	9.9e-1	7.3e+1	7.0e+1	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	1.1e+2	5.6e+1	1.1e+1	1.0e+0
10000	1000	500	9.9e-1	1.0e+0	6.6e+1	9.9e-1	7.1e+1	7.1e+1	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	1.1e+2	5.8e+1	1.1e+1	1.0e+0
10000	1	1000	9.4e-1	9.9e-1	2.8e+0	9.5e-1	6.5e+0	6.6e+0	NaN	NaN	NaN	NaN	1.1e+0	6.9e-1	3.5e+0	3.4e+0	2.9e+0	1.0e+0
10000	1000	1	1.0e+0	1.0e+0	2.7e+0	1.0e+0	6.0e+0	6.1e+0	NaN	NaN	NaN	NaN	1.1e+0	7.3e-1	3.6e+0	3.5e+0	3.0e+0	9.7e-1
10000	2500	2500	1.0e+0	1.0e+0	9.4e+1	1.1e+0	9.2e+1	9.2e+1	3.9e+1	3.9e+1	3.9e+1	9.9e-1	1.1e+0	5.9e-1	4.2e+1	1.6e+1	5.7e+0	1.0e+0
10000	1250	2500	1.0e+0	1.0e+0	4.2e+1	1.1e+0	4.2e+1	4.3e+1	NaN	NaN	NaN	NaN	1.1e+0	5.8e-1	6.5e+1	3.0e+1	6.5e+0	1.1e+0
10000	2500	1250	9.8e-1	1.0e+0	4.1e+1	1.1e+0	4.2e+1	4.3e+1	NaN	NaN	NaN	NaN	1.1e+0	5.9e-1	6.8e+1	3.0e+1	6.8e+0	1.1e+0
10000	1	2500	1.0e+0	1.0e+0	4.8e+0	9.9e-1	1.3e+1	1.3e+1	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	7.0e+0	6.8e+0	4.7e+0	9.9e-1
10000	2500	1	9.6e-1	1.0e+0	4.4e+0	1.0e+0	9.7e+0	9.5e+0	NaN	NaN	NaN	NaN	1.0e+0	6.1e-1	6.6e+0	6.0e+0	4.4e+0	9.9e-1
10000	5000	5000	1.0e+0	1.0e+0	1.5e+4	1.1e+0	2.4e+4	2.4e+4	7.1e+1	6.9e+1	7.0e+1	1.1e+0	1.1e+0	5.7e-1	3.1e+1	1.2e+1	5.8e+0	1.0e+0
10000	2500	5000	1.0e+0	1.0e+0	8.3e+3	1.0e+0	1.6e+4	1.6e+4	NaN	NaN	NaN	NaN	1.1e+0	6.2e-1	3.1e+1	1.1e+1	5.7e+0	1.0e+0
10000	5000	2500	1.0e+0	1.0e+0	8.3e+3	1.0e+0	1.5e+4	1.4e+4	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	3.0e+1	1.1e+1	5.4e+0	1.0e+0
10000	1	5000	9.5e-1	1.0e+0	8.5e+0	1.0e+0	2.3e+1	2.2e+1	NaN	NaN	NaN	NaN	1.1e+0	5.8e-1	1.2e+1	1.1e+1	6.2e+0	1.0e+0
10000	5000	1	1.1e+0	1.0e+0	7.0e+0	9.9e-1	1.3e+1	1.3e+1	NaN	NaN	NaN	NaN	1.0e+0	6.4e-1	9.9e+0	9.4e+0	5.8e+0	1.0e+0
10000	10000	10000	1.0e+0	1.0e+0	5.1e+4	1.1e+0	7.2e+4	7.4e+4	1.4e+2	1.4e+2	1.4e+2	1.1e+0	1.1e+0	6.2e-1	3.4e+1	1.3e+1	6.3e+0	1.0e+0
10000	5000	10000	1.0e+0	1.0e+0	3.3e+4	1.1e+0	5.7e+4	5.5e+4	NaN	NaN	NaN	NaN	1.1e+0	5.9e-1	3.3e+1	1.2e+1	6.1e+0	1.1e+0
10000	10000	5000	1.0e+0	1.0e+0	2.8e+4	1.1e+0	4.5e+4	4.5e+4	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	3.3e+1	1.2e+1	6.0e+0	1.0e+0
10000	1	10000	1.0e+0	1.0e+0	1.4e+1	9.9e-1	3.2e+1	3.3e+1	NaN	NaN	NaN	NaN	1.1e+0	6.0e-1	2.2e+1	1.8e+1	8.4e+0	9.9e-1
10000	10000	1	1.0e+0	1.0e+0	1.0e+1	1.0e+0	1.6e+1	1.6e+1	NaN	NaN	NaN	NaN	1.0e+0	6.2e-1	1.6e+1	1.4e+1	7.3e+0	1.0e+0

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
4194319	5	5	9.5e-1	9.6e-1	1.2e+0	9.8e-1	1.9e+0	1.8e+0	1.1e+0	1.4e+0	1.5e+0	1.0e+0	9.9e-1	9.0e-1	1.3e+0	1.3e+0	1.3e+0	9.8e-1
4194319	2	5	9.6e-1	9.7e-1	1.2e+0	9.6e-1	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	1.1e+0	9.2e-1	1.2e+0	1.1e+0	1.1e+0	9.5e-1
4194319	5	2	9.4e-1	9.6e-1	1.1e+0	9.7e-1	1.6e+0	1.5e+0	NaN	NaN	NaN	NaN	1.0e+0	9.5e-1	1.1e+0	1.1e+0	1.1e+0	9.5e-1
4194319	1	5	9.5e-1	9.9e-1	1.1e+0	9.9e-1	1.2e+0	1.3e+0	NaN	NaN	NaN	NaN	1.0e+0	9.3e-1	1.1e+0	1.1e+0	1.1e+0	1.0e+0
4194319	5	1	9.9e-1	9.3e-1	1.1e+0	9.7e-1	1.3e+0	1.4e+0	NaN	NaN	NaN	NaN	9.8e-1	9.4e-1	1.1e+0	1.1e+0	1.1e+0	9.7e-1
4194319	10	10	9.8e-1	9.8e-1	2.0e+0	9.9e-1	4.2e+0	4.1e+0	1.7e+0	2.8e+0	3.1e+0	9.9e-1	1.1e+0	8.6e-1	2.1e+0	1.9e+0	1.9e+0	9.8e-1
4194319	5	10	9.6e-1	9.8e-1	1.5e+0	9.7e-1	3.3e+0	3.2e+0	NaN	NaN	NaN	NaN	1.1e+0	8.8e-1	1.5e+0	1.5e+0	1.4e+0	9.7e-1
4194319	10	5	9.7e-1	9.9e-1	1.6e+0	9.8e-1	3.2e+0	3.3e+0	NaN	NaN	NaN	NaN	1.0e+0	8.8e-1	1.5e+0	1.5e+0	1.5e+0	9.9e-1
4194319	1	10	9.8e-1	9.5e-1	1.1e+0	9.7e-1	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	1.0e+0	9.5e-1	1.1e+0	1.2e+0	1.2e+0	9.3e-1
4194319	10	1	9.5e-1	9.6e-1	1.1e+0	9.7e-1	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	1.0e+0	9.6e-1	1.2e+0	1.2e+0	1.2e+0	1.0e+0
4194319	25	25	9.3e-1	9.9e-1	6.5e+0	9.3e-1	1.9e+1	1.9e+1	4.9e+0	9.4e+0	9.8e+0	9.8e-1	1.1e+0	8.4e-1	7.3e+0	6.9e+0	4.5e+0	1.0e+0
4194319	12	25	1.1e+0	1.0e+0	4.3e+0	1.1e+0	1.4e+1	1.4e+1	NaN	NaN	NaN	NaN	1.1e+0	8.6e-1	4.2e+0	4.0e+0	3.1e+0	9.8e-1
4194319	25	12	1.1e+0	1.0e+0	4.3e+0	1.1e+0	1.4e+1	1.4e+1	NaN	NaN	NaN	NaN	1.1e+0	8.5e-1	4.2e+0	4.0e+0	3.3e+0	9.8e-1
4194319	1	25	9.7e-1	9.7e-1	1.3e+0	9.5e-1	2.1e+0	2.1e+0	NaN	NaN	NaN	NaN	1.0e+0	9.0e-1	1.3e+0	1.3e+0	1.3e+0	9.9e-1
4194319	25	1	9.5e-1	9.8e-1	1.3e+0	9.8e-1	2.2e+0	2.2e+0	NaN	NaN	NaN	NaN	9.7e-1	9.1e-1	1.3e+0	1.3e+0	1.3e+0	9.4e-1
4194319	50	50	9.6e-1	1.0e+0	2.1e+1	9.9e-1	5.8e+1	6.0e+1	1.4e+1	2.2e+1	2.3e+1	9.8e-1	1.1e+0	7.9e-1	2.4e+1	2.0e+1	7.9e+0	9.8e-1
4194319	25	50	1.0e+0	1.0e+0	1.4e+1	9.8e-1	4.7e+1	4.6e+1	NaN	NaN	NaN	NaN	1.1e+0	8.2e-1	1.3e+1	1.2e+1	6.5e+0	1.0e+0
4194319	50	25	1.0e+0	9.8e-1	1.4e+1	1.0e+0	4.7e+1	4.7e+1	NaN	NaN	NaN	NaN	1.1e+0	8.2e-1	1.3e+1	1.2e+1	6.2e+0	9.9e-1
4194319	1	50	9.6e-1	9.7e-1	1.5e+0	9.8e-1	3.1e+0	3.2e+0	NaN	NaN	NaN	NaN	1.0e+0	8.9e-1	1.5e+0	1.5e+0	1.5e+0	9.8e-1
4194319	50	1	9.7e-1	9.7e-1	1.6e+0	9.6e-1	3.2e+0	3.2e+0	NaN	NaN	NaN	NaN	1.0e+0	9.0e-1	1.5e+0	1.5e+0	1.5e+0	9.4e-1
4194319	100	100	1.1e+0	1.0e+0	7.5e+1	9.7e-1	1.8e+2	1.8e+2	3.6e+1	5.2e+1	5.1e+1	9.9e-1	1.1e+0	7.9e-1	7.7e+1	4.6e+1	9.9e+0	1.0e+0
4194319	50	100	1.0e+0	1.0e+0	4.9e+1	1.0e+0	1.5e+2	1.5e+2	NaN	NaN	NaN	NaN	1.1e+0	7.9e-1	4.5e+1	3.2e+1	9.4e+0	1.0e+0
4194319	100	50	1.0e+0	1.0e+0	4.9e+1	1.1e+0	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	1.1e+0	7.8e-1	4.6e+1	3.3e+1	8.7e+0	1.0e+0
4194319	1	100	9.8e-1	9.6e-1	2.1e+0	9.6e-1	5.2e+0	5.3e+0	NaN	NaN	NaN	NaN	1.0e+0	8.6e-1	2.0e+0	2.0e+0	1.8e+0	9.6e-1
4194319	100	1	9.8e-1	9.7e-1	2.1e+0	1.0e+0	5.2e+0	5.3e+0	NaN	NaN	NaN	NaN	1.0e+0	8.9e-1	2.1e+0	2.1e+0	1.9e+0	9.2e-1
4194319	250	250	1.0e+0	1.0e+0	2.6e+2	1.0e+0	4.0e+2	4.0e+2	1.1e+2	1.2e+2	1.2e+2	1.0e+0	1.1e+0	7.8e-1	2.4e+2	7.7e+1	1.1e+1	1.0e+0
4194319	125	250	9.8e-1	1.0e+0	2.0e+2	9.9e-1	3.8e+2	3.8e+2	NaN	NaN	NaN	NaN	1.1e+0	7.9e-1	1.7e+2	6.8e+1	1.0e+1	1.0e+0
4194319	250	125	9.8e-1	1.0e+0	2.0e+2	9.8e-1	3.7e+2	3.7e+2	NaN	NaN	NaN	NaN	1.1e+0	8.0e-1	1.7e+2	6.9e+1	1.1e+1	1.0e+0
4194319	1	250	9.7e-1	9.9e-1	3.7e+0	9.5e-1	1.1e+1	1.1e+1	NaN	NaN	NaN	NaN	1.1e+0	8.6e-1	3.5e+0	3.6e+0	2.9e+0	9.6e-1
4194319	250	1	9.9e-1	9.7e-1	3.7e+0	9.7e-1	1.1e+1	1.1e+1	NaN	NaN	NaN	NaN	1.0e+0	8.4e-1	3.7e+0	3.5e+0	3.0e+0	9.6e-1
4194319	500	500	1.0e+0	9.9e-1	4.0e+2	1.0e+0	4.8e+2	4.6e+2	2.0e+2	2.1e+2	2.2e+2	9.9e-1	1.1e+0	8.1e-1	3.3e+2	8.7e+1	1.1e+1	9.7e-1
4194319	250	500	1.0e+0	9.9e-1	3.7e+2	9.8e-1	4.6e+2	4.6e+2	NaN	NaN	NaN	NaN	1.1e+0	7.7e-1	2.9e+2	8.8e+1	1.1e+1	9.8e-1
4194319	500	250	1.0e+0	1.0e+0	3.7e+2	9.9e-1	4.7e+2	4.6e+2	NaN	NaN	NaN	NaN	1.1e+0	7.7e-1	3.0e+2	8.4e+1	1.1e+1	1.0e+0
4194319	1	500	1.0e+0	1.0e+0	6.7e+0	1.0e+0	2.1e+1	2.1e+1	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	6.1e+0	5.9e+0	4.1e+0	9.6e-1
4194319	500	1	1.0e+0	9.8e-1	6.2e+0	1.0e+0	1.9e+1	1.9e+1	NaN	NaN	NaN	NaN	1.0e+0	8.4e-1	6.0e+0	6.0e+0	4.1e+0	9.8e-1
4194319	1000	1000	1.0e+0	1.0e+0	4.4e+2	9.9e-1	4.5e+2	4.7e+2	2.7e+2	2.7e+2	2.8e+2	9.8e-1	1.1e+0	7.9e-1	3.3e+2	8.7e+1	9.6e+0	1.0e+0
4194319	500	1000	1.0e+0	1.0e+0	4.7e+2	9.9e-1	5.0e+2	5.0e+2	NaN	NaN	NaN	NaN	1.1e+0	7.8e-1	3.6e+2	8.5e+1	1.1e+1	1.0e+0
4194319	1000	500	1.0e+0	1.0e+0	4.7e+2	1.0e+0	5.0e+2	5.0e+2	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	3.6e+2	9.1e+1	1.1e+1	1.0e+0
4194319	1	1000	9.1e-1	9.8e-1	1.1e+1	9.2e-1	3.7e+1	3.7e+1	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	1.0e+1	9.7e+0	5.4e+0	9.3e-1
4194319	1000	1	9.3e-1	9.9e-1	1.1e+1	9.3e-1	3.1e+1	3.0e+1	NaN	NaN	NaN	NaN	1.0e+0	8.2e-1	1.0e+1	9.3e+0	5.5e+0	9.2e-1
4194319	2500	2500	1.0e+0	1.0e+0	5.8e+2	1.0e+0	6.0e+2	5.9e+2	2.1e+2	2.0e+2	2.1e+2	1.0e+0	1.1e+0	8.0e-1	1.5e+2	4.4e+1	9.0e+0	9.9e-1
4194319	1250	2500	9.5e-1	1.0e+0	3.0e+2	1.1e+0	3.0e+2	3.0e+2	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	2.4e+2	6.6e+1	9.6e+0	1.0e+0
4194319	2500	1250	9.8e-1	1.0e+0	2.9e+2	1.2e+0	3.0e+2	3.1e+2	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	2.4e+2	6.5e+1	9.6e+0	1.1e+0
4194319	1	2500	1.0e+0	1.0e+0	2.5e+1	1.0e+0	7.6e+1	7.3e+1	NaN	NaN	NaN	NaN	1.1e+0	7.9e-1	2.3e+1	2.0e+1	8.0e+0	1.0e+0
4194319	2500	1	1.0e+0	1.0e+0	2.2e+1	1.0e+0	5.1e+1	5.1e+1	NaN	NaN	NaN	NaN	1.0e+0	8.1e-1	2.1e+1	1.7e+1	7.5e+0	9.7e-1
4194319	5000	5000	1.0e+0	1.0e+0	8.7e+4	1.1e+0	1.5e+5	1.5e+5	3.8e+2	3.8e+2	3.9e+2	1.1e+0	1.1e+0	7.9e-1	1.1e+2	3.3e+1	8.8e+0	1.0e+0
4194319	2500	5000	1.0e+0	9.9e-1	5.1e+4	1.1e+0	9.3e+4	9.4e+4	NaN	NaN	NaN	NaN	1.1e+0	7.9e-1	1.0e+2	3.1e+1	8.5e+0	1.0e+0
4194319	5000	2500	1.0e+0	1.0e+0	4.9e+4	1.0e+0	8.9e+4	8.7e+4	NaN	NaN	NaN	NaN	1.1e+0	8.0e-1	1.1e+2	3.2e+1	8.4e+0	1.0e+0
4194319	1	5000	1.0e+0	9.7e-1	4.9e+1	1.0e+0	1.4e+2	1.5e+2	NaN	NaN	NaN	NaN	1.1e+0	7.8e-1	4.6e+1	3.2e+1	9.1e+0	9.8e-1
4194319	5000	1	9.9e-1	1.0e+0	3.6e+1	9.7e-1	7.3e+1	7.3e+1	NaN	NaN	NaN	NaN	1.0e+0	8.1e-1	3.6e+1	2.8e+1	9.1e+0	1.0e+0
4194319	10000	10000	9.9e-1	1.0e+0	3.0e+5	1.1e+0	4.6e+5	4.6e+5	7.8e+2	7.9e+2	7.7e+2	1.1e+0	1.1e+0	7.9e-1	1.1e+2	3.5e+1	8.5e+0	1.0e+0
4194319	5000	10000	1.1e+0	1.0e+0	2.0e+5	1.1e+0	3.5e+5	3.5e+5	NaN	NaN	NaN	NaN	1.1e+0	8.0e-1	1.1e+2	3.3e+1	8.6e+0	1.0e+0
4194319	10000	5000	1.0e+0	1.0e+0	1.8e+5	1.1e+0	2.8e+5	2.9e+5	NaN	NaN	NaN	NaN	1.1e+0	8.0e-1	1.1e+2	3.3e+1	8.4e+0	1.0e+0
4194319	1	10000	9.2e-1	1.0e+0	8.4e+1	9.5e-1	2.2e+2	2.2e+2	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	8.0e+1	4.7e+1	9.8e+0	9.9e-1
4194319	10000	1	1.0e+0	1.0e+0	5.5e+1	9.9e-1	9.1e+1	9.3e+1	NaN	NaN	NaN	NaN	1.0e+0	8.3e-1	5.4e+1	3.8e+1	9.8e+0	1.0e+0

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
8388607	5	5	9.6e-1	9.8e-1	1.3e+0	9.7e-1	1.9e+0	1.8e+0	1.2e+0	1.5e+0	1.5e+0	9.8e-1	1.0e+0	9.3e-1	1.3e+0	1.3e+0	1.3e+0	9.7e-1
8388607	2	5	9.9e-1	9.6e-1	1.1e+0	9.8e-1	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	9.9e-1	9.5e-1	1.1e+0	1.1e+0	1.1e+0	9.8e-1
8388607	5	2	9.5e-1	9.5e-1	1.2e+0	9.7e-1	1.6e+0	1.6e+0	NaN	NaN	NaN	NaN	9.9e-1	9.5e-1	1.2e+0	1.1e+0	1.1e+0	9.9e-1
8388607	1	5	9.6e-1	1.0e+0	1.1e+0	1.0e+0	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	1.0e+0	9.5e-1	1.1e+0	1.1e+0	1.1e+0	9.5e-1
8388607	5	1	9.8e-1	1.0e+0	1.1e+0	1.0e+0	1.3e+0	1.3e+0	NaN	NaN	NaN	NaN	9.9e-1	9.7e-1	1.1e+0	1.1e+0	1.1e+0	9.4e-1
8388607	10	10	9.5e-1	1.0e+0	2.0e+0	9.9e-1	4.2e+0	4.0e+0	1.8e+0	2.8e+0	3.1e+0	1.0e+0	1.1e+0	8.7e-1	2.1e+0	2.1e+0	1.9e+0	1.0e+0
8388607	5	10	9.2e-1	1.0e+0	1.6e+0	9.9e-1	3.2e+0	3.2e+0	NaN	NaN	NaN	NaN	1.0e+0	8.8e-1	1.6e+0	1.5e+0	1.5e+0	9.5e-1
8388607	10	5	9.6e-1	1.0e+0	1.6e+0	1.0e+0	3.2e+0	3.2e+0	NaN	NaN	NaN	NaN	1.0e+0	9.1e-1	1.6e+0	1.6e+0	1.5e+0	9.7e-1
8388607	1	10	9.5e-1	9.8e-1	1.2e+0	9.8e-1	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	1.0e+0	9.8e-1	1.1e+0	1.1e+0	1.1e+0	9.5e-1
8388607	10	1	9.6e-1	9.9e-1	1.2e+0	1.0e+0	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	9.8e-1	9.5e-1	1.2e+0	1.1e+0	1.2e+0	1.0e+0
8388607	25	25	1.0e+0	1.1e+0	6.8e+0	1.0e+0	1.8e+1	1.9e+1	5.2e+0	9.8e+0	1.0e+1	9.9e-1	1.1e+0	8.5e-1	7.7e+0	7.1e+0	4.8e+0	1.0e+0
8388607	12	25	9.8e-1	9.8e-1	4.7e+0	9.7e-1	1.3e+1	1.3e+1	NaN	NaN	NaN	NaN	1.0e+0	8.2e-1	4.2e+0	4.1e+0	3.3e+0	9.7e-1
8388607	25	12	9.9e-1	1.0e+0	4.5e+0	9.6e-1	1.4e+1	1.4e+1	NaN	NaN	NaN	NaN	1.1e+0	8.3e-1	4.2e+0	4.2e+0	3.2e+0	9.7e-1
8388607	1	25	9.4e-1	9.7e-1	1.3e+0	9.8e-1	2.1e+0	2.1e+0	NaN	NaN	NaN	NaN	1.0e+0	8.9e-1	1.3e+0	1.3e+0	1.2e+0	9.7e-1
8388607	25	1	1.0e+0	1.0e+0	1.3e+0	1.0e+0	2.0e+0	2.1e+0	NaN	NaN	NaN	NaN	9.9e-1	9.2e-1	1.3e+0	1.3e+0	1.3e+0	9.9e-1
8388607	50	50	9.4e-1	1.0e+0	2.2e+1	1.0e+0	5.8e+1	5.9e+1	1.4e+1	2.3e+1	2.4e+1	9.9e-1	1.0e+0	8.2e-1	2.5e+1	2.1e+1	7.9e+0	1.0e+0
8388607	25	50	1.0e+0	1.0e+0	1.5e+1	1.0e+0	4.7e+1	4.7e+1	NaN	NaN	NaN	NaN	1.1e+0	8.5e-1	1.5e+1	1.2e+1	6.6e+0	9.8e-1
8388607	50	25	9.9e-1	1.0e+0	1.5e+1	1.0e+0	4.7e+1	4.7e+1	NaN	NaN	NaN	NaN	1.1e+0	7.9e-1	1.5e+1	1.2e+1	6.6e+0	1.0e+0
8388607	1	50	9.9e-1	9.9e-1	1.7e+0	1.0e+0	3.1e+0	3.2e+0	NaN	NaN	NaN	NaN	1.0e+0	8.9e-1	1.5e+0	1.6e+0	1.5e+0	4.4e+0
8388607	50	1	1.3e+0	1.4e+0	1.7e+0	9.9e-1	3.2e+0	3.2e+0	NaN	NaN	NaN	NaN	1.0e+0	9.0e-1	1.6e+0	1.6e+0	1.5e+0	9.6e-1
8388607	100	100	9.7e-1	1.0e+0	7.8e+1	9.3e-1	1.7e+2	1.8e+2	3.8e+1	5.6e+1	5.5e+1	1.0e+0	1.1e+0	8.3e-1	8.1e+1	4.8e+1	1.0e+1	9.9e-1
8388607	50	100	1.0e+0	1.0e+0	5.2e+1	1.0e+0	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	1.1e+0	8.4e-1	4.7e+1	3.5e+1	9.2e+0	1.0e+0
8388607	100	50	9.8e-1	1.0e+0	5.1e+1	9.4e-1	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	4.8e+1	3.2e+1	9.1e+0	9.9e-1
8388607	1	100	9.9e-1	9.8e-1	2.2e+0	9.8e-1	5.3e+0	5.3e+0	NaN	NaN	NaN	NaN	1.1e+0	9.0e-1	2.1e+0	2.1e+0	1.9e+0	9.6e-1
8388607	100	1	1.0e+0	9.8e-1	2.2e+0	9.9e-1	5.2e+0	5.1e+0	NaN	NaN	NaN	NaN	1.0e+0	8.7e-1	2.1e+0	2.1e+0	2.0e+0	1.0e+0
8388607	250	250	1.0e+0	1.0e+0	2.6e+2	1.0e+0	3.9e+2	3.9e+2	1.1e+2	1.3e+2	1.3e+2	9.8e-1	1.1e+0	8.0e-1	2.5e+2	7.9e+1	1.1e+1	1.0e+0
8388607	125	250	1.0e+0	1.0e+0	2.1e+2	1.0e+0	3.6e+2	3.5e+2	NaN	NaN	NaN	NaN	1.1e+0	8.0e-1	1.8e+2	7.3e+1	1.1e+1	9.8e-1
8388607	250	125	1.0e+0	1.0e+0	2.1e+2	1.0e+0	3.5e+2	3.6e+2	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	1.8e+2	7.1e+1	1.1e+1	9.9e-1
8388607	1	250	9.9e-1	9.9e-1	4.0e+0	9.8e-1	1.1e+1	1.1e+1	NaN	NaN	NaN	NaN	1.1e+0	8.7e-1	3.7e+0	3.6e+0	3.0e+0	1.0e+0
8388607	250	1	1.0e+0	1.0e+0	3.8e+0	9.8e-1	1.1e+1	1.0e+1	NaN	NaN	NaN	NaN	1.0e+0	8.6e-1	3.7e+0	3.8e+0	2.9e+0	9.5e-1
8388607	500	500	1.0e+0	9.9e-1	4.0e+2	9.8e-1	4.5e+2	4.6e+2	1.9e+2	2.2e+2	2.1e+2	9.9e-1	1.1e+0	8.0e-1	3.4e+2	9.3e+1	1.2e+1	9.9e-1
8388607	250	500	1.0e+0	9.5e-1	3.8e+2	9.8e-1	4.5e+2	4.6e+2	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	2.9e+2	8.7e+1	1.1e+1	1.0e+0
8388607	500	250	9.9e-1	1.0e+0	3.6e+2	1.0e+0	4.4e+2	4.5e+2	NaN	NaN	NaN	NaN	1.2e+0	7.6e-1	2.9e+2	8.5e+1	1.1e+1	9.9e-1
8388607	1	500	1.0e+0	9.9e-1	6.6e+0	1.0e+0	2.0e+1	2.0e+1	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	6.0e+0	5.8e+0	4.1e+0	9.8e-1
8388607	500	1	1.0e+0	1.0e+0	6.5e+0	1.0e+0	1.7e+1	1.8e+1	NaN	NaN	NaN	NaN	1.0e+0	8.4e-1	5.8e+0	5.8e+0	4.1e+0	9.6e-1
8388607	1000	1000	9.9e-1	1.0e+0	4.3e+2	9.8e-1	4.6e+2	4.5e+2	2.7e+2	2.9e+2	2.9e+2	9.7e-1	1.1e+0	8.3e-1	3.5e+2	8.7e+1	9.9e+0	1.0e+0
8388607	500	1000	1.0e+0	9.9e-1	4.7e+2	1.0e+0	4.9e+2	4.9e+2	NaN	NaN	NaN	NaN	1.1e+0	8.2e-1	3.6e+2	9.1e+1	1.1e+1	1.0e+0
8388607	1000	500	1.0e+0	1.0e+0	4.6e+2	1.1e+0	4.7e+2	4.8e+2	NaN	NaN	NaN	NaN	1.1e+0	8.2e-1	3.6e+2	9.5e+1	1.1e+1	1.0e+0
8388607	1	1000	9.6e-1	9.9e-1	1.2e+1	9.9e-1	3.9e+1	3.9e+1	NaN	NaN	NaN	NaN	1.1e+0	8.2e-1	1.1e+1	1.0e+1	5.7e+0	9.5e-1
8388607	1000	1	9.8e-1	1.0e+0	1.2e+1	1.0e+0	3.2e+1	3.0e+1	NaN	NaN	NaN	NaN	1.0e+0	8.4e-1	1.1e+1	9.8e+0	5.6e+0	9.7e-1
8388607	2500	2500	1.0e+0	1.0e+0	5.7e+2	1.0e+0	6.0e+2	5.9e+2	2.0e+2	2.1e+2	2.0e+2	1.0e+0	1.1e+0	7.9e-1	1.5e+2	4.3e+1	9.1e+0	1.0e+0
8388607	1250	2500	9.8e-1	1.0e+0	3.0e+2	1.2e+0	3.0e+2	2.9e+2	NaN	NaN	NaN	NaN	1.1e+0	8.0e-1	2.3e+2	6.6e+1	9.8e+0	1.1e+0
8388607	2500	1250	9.8e-1	1.0e+0	3.0e+2	1.2e+0	2.9e+2	3.0e+2	NaN	NaN	NaN	NaN	1.1e+0	8.2e-1	2.3e+2	6.6e+1	9.6e+0	1.0e+0
8388607	1	2500	1.1e+0	1.0e+0	2.9e+1	1.2e+0	8.5e+1	8.4e+1	NaN	NaN	NaN	NaN	1.1e+0	8.0e-1	2.6e+1	2.1e+1	8.1e+0	1.1e+0
8388607	2500	1	1.1e+0	1.0e+0	2.3e+1	1.1e+0	5.1e+1	5.1e+1	NaN	NaN	NaN	NaN	1.0e+0	8.0e-1	2.3e+1	1.9e+1	7.8e+0	1.0e+0
8388607	5000	5000	1.0e+0	1.0e+0	8.3e+4	1.1e+0	1.5e+5	1.4e+5	3.9e+2	3.8e+2	3.8e+2	1.1e+0	1.1e+0	8.0e-1	1.1e+2	3.4e+1	8.9e+0	1.1e+0
8388607	2500	5000	1.0e+0	9.9e-1	5.6e+4	1.0e+0	1.0e+5	1.0e+5	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	1.0e+2	3.2e+1	8.4e+0	1.0e+0
8388607	5000	2500	1.0e+0	1.0e+0	5.2e+4	1.0e+0	8.8e+4	8.6e+4	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	1.1e+2	3.2e+1	8.6e+0	1.0e+0
8388607	1	5000	9.7e-1	1.0e+0	5.2e+1	1.0e+0	1.4e+2	1.4e+2	NaN	NaN	NaN	NaN	1.1e+0	8.4e-1	4.8e+1	3.5e+1	9.5e+0	1.0e+0
8388607	5000	1	1.0e+0	1.0e+0	3.6e+1	1.0e+0	6.8e+1	7.0e+1	NaN	NaN	NaN	NaN	1.0e+0	8.3e-1	3.7e+1	2.9e+1	9.1e+0	1.0e+0
8388607	10000	10000	1.0e+0	1.0e+0	3.0e+5	1.1e+0	4.4e+5	4.5e+5	7.7e+2	7.6e+2	7.8e+2	1.1e+0	1.1e+0	8.0e-1	1.1e+2	3.4e+1	8.5e+0	1.0e+0
8388607	5000	10000	1.0e+0	1.0e+0	1.9e+5	1.1e+0	3.0e+5	3.1e+5	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	1.1e+2	3.2e+1	8.6e+0	1.0e+0
8388607	10000	5000	1.0e+0	1.0e+0	1.6e+5	1.1e+0	2.4e+5	2.5e+5	NaN	NaN	NaN	NaN	1.1e+0	8.1e-1	1.1e+2	3.3e+1	8.7e+0	9.9e-1
8388607	1	10000	1.1e+0	1.0e+0	9.1e+1	1.0e+0	2.1e+2	2.1e+2	NaN	NaN	NaN	NaN	1.1e+0	8.3e-1	7.9e+1	4.8e+1	1.0e+1	9.9e-1
8388607	10000	1	1.0e+0	1.0e+0	5.6e+1	1.0e+0	8.8e+1	8.7e+1	NaN	NaN	NaN	NaN	1.0e+0	8.3e-1	5.4e+1	3.8e+1	9.8e+0	1.0e+0

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
67108879	5	5	5.7e-1	5.7e+0	1.2e+0	6.1e-1	8.7e-1	8.6e-1	1.1e+0	7.1e-1	7.0e-1	7.4e-1	1.0e+0	9.4e-1	1.2e+0	1.3e+0	1.3e+0	1.2e+0
67108879	2	5	5.5e-1	3.4e+0	1.3e+0	5.6e-1	8.1e-1	7.9e-1	NaN	NaN	NaN	NaN	1.1e+0	9.9e-1	1.2e+0	1.3e+0	1.2e+0	1.3e+0
67108879	5	2	5.4e-1	3.3e+0	1.3e+0	5.6e-1	7.7e-1	7.7e-1	NaN	NaN	NaN	NaN	1.0e+0	1.0e+0	1.3e+0	1.2e+0	1.3e+0	1.2e+0
67108879	1	5	5.5e-1	2.5e+0	1.3e+0	5.7e-1	7.4e-1	7.6e-1	NaN	NaN	NaN	NaN	1.0e+0	1.1e+0	1.2e+0	1.2e+0	1.2e+0	1.2e+0
67108879	5	1	5.3e-1	2.5e+0	1.3e+0	5.5e-1	7.7e-1	7.7e-1	NaN	NaN	NaN	NaN	1.0e+0	1.1e+0	1.2e+0	1.3e+0	1.2e+0	1.3e+0
67108879	10	10	7.4e-1	1.6e+1	1.4e+0	8.6e-1	1.4e+0	1.4e+0	1.3e+0	9.7e-1	9.7e-1	9.0e-1	1.0e+0	6.8e-1	1.6e+0	1.6e+0	1.4e+0	1.4e+0
67108879	5	10	5.8e-1	9.7e+0	1.4e+0	6.5e-1	1.1e+0	1.2e+0	NaN	NaN	NaN	NaN	1.0e+0	8.0e-1	1.4e+0	1.4e+0	1.3e+0	1.3e+0
67108879	10	5	5.7e-1	9.5e+0	1.4e+0	6.4e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	7.6e-1	1.4e+0	1.4e+0	1.3e+0	1.3e+0
67108879	1	10	5.4e-1	3.3e+0	1.3e+0	5.8e-1	8.1e-1	8.0e-1	NaN	NaN	NaN	NaN	1.0e+0	9.9e-1	1.2e+0	1.2e+0	1.2e+0	1.3e+0
67108879	10	1	5.4e-1	3.3e+0	1.3e+0	5.7e-1	7.8e-1	8.0e-1	NaN	NaN	NaN	NaN	9.8e-1	1.0e+0	1.2e+0	1.2e+0	1.2e+0	1.2e+0
67108879	25	25	1.3e+0	5.4e+1	2.4e+0	1.9e+0	4.4e+0	4.4e+0	1.8e+0	2.2e+0	2.2e+0	1.3e+0	1.0e+0	3.8e-1	3.3e+0	3.2e+0	2.1e+0	1.5e+0
67108879	12	25	9.5e-1	3.4e+1	2.0e+0	1.3e+0	3.3e+0	3.3e+0	NaN	NaN	NaN	NaN	1.1e+0	4.6e-1	2.2e+0	2.2e+0	1.8e+0	1.4e+0
67108879	25	12	9.3e-1	3.5e+1	2.0e+0	1.3e+0	3.3e+0	3.3e+0	NaN	NaN	NaN	NaN	1.0e+0	4.7e-1	2.3e+0	2.3e+0	1.8e+0	1.3e+0
67108879	1	25	5.6e-1	5.7e+0	1.3e+0	6.1e-1	9.0e-1	9.3e-1	NaN	NaN	NaN	NaN	1.0e+0	9.3e-1	1.3e+0	1.3e+0	1.2e+0	1.2e+0
67108879	25	1	5.5e-1	5.6e+0	1.3e+0	5.9e-1	8.8e-1	9.0e-1	NaN	NaN	NaN	NaN	1.0e+0	8.8e-1	1.3e+0	1.2e+0	1.3e+0	1.2e+0
67108879	50	50	4.3e+0	8.4e+1	5.6e+0	4.7e+0	1.3e+1	1.4e+1	3.5e+0	4.8e+0	4.9e+0	1.9e+0	1.0e+0	3.1e-1	9.1e+0	7.1e+0	2.8e+0	2.3e+0
67108879	25	50	2.4e+0	7.1e+1	3.9e+0	2.9e+0	1.0e+1	9.7e+0	NaN	NaN	NaN	NaN	1.0e+0	3.4e-1	5.3e+0	4.7e+0	2.5e+0	1.7e+0
67108879	50	25	2.3e+0	7.2e+1	4.0e+0	2.8e+0	1.0e+1	9.7e+0	NaN	NaN	NaN	NaN	1.0e+0	3.5e-1	5.2e+0	4.8e+0	2.5e+0	1.7e+0
67108879	1	50	5.7e-1	9.5e+0	1.4e+0	6.5e-1	1.1e+0	1.2e+0	NaN	NaN	NaN	NaN	1.0e+0	7.9e-1	1.4e+0	1.4e+0	1.3e+0	1.3e+0
67108879	50	1	5.6e-1	9.1e+0	1.4e+0	6.2e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.9e-1	7.9e-1	1.4e+0	1.4e+0	1.3e+0	1.2e+0
67108879	100	100	1.0e+1	1.0e+2	1.5e+1	8.1e+0	3.3e+1	3.3e+1	7.9e+0	1.0e+1	1.1e+1	3.0e+0	1.0e+0	3.1e-1	2.5e+1	1.5e+1	3.1e+0	4.2e+0
67108879	50	100	7.1e+0	9.4e+1	1.1e+1	6.9e+0	2.8e+1	2.8e+1	NaN	NaN	NaN	NaN	1.1e+0	3.2e-1	1.5e+1	1.1e+1	3.0e+0	2.9e+0
67108879	100	50	7.3e+0	9.6e+1	1.1e+1	6.7e+0	2.7e+1	2.7e+1	NaN	NaN	NaN	NaN	1.0e+0	3.0e-1	1.5e+1	1.1e+1	3.0e+0	2.9e+0
67108879	1	100	7.3e-1	1.6e+1	1.5e+0	8.6e-1	1.5e+0	1.6e+0	NaN	NaN	NaN	NaN	1.0e+0	6.4e-1	1.6e+0	1.6e+0	1.5e+0	1.3e+0
67108879	100	1	6.9e-1	1.5e+1	1.5e+0	8.3e-1	1.6e+0	1.6e+0	NaN	NaN	NaN	NaN	9.6e-1	6.7e-1	1.5e+0	1.6e+0	1.4e+0	1.3e+0
67108879	250	250	1.2e+1	1.1e+2	4.8e+1	1.0e+1	7.2e+1	7.4e+1	2.0e+1	2.4e+1	2.4e+1	5.2e+0	9.9e-1	3.1e-1	7.2e+1	2.4e+1	3.3e+0	9.6e+0
67108879	125	250	1.2e+1	1.1e+2	3.8e+1	9.4e+0	6.6e+1	6.6e+1	NaN	NaN	NaN	NaN	1.0e+0	3.2e-1	5.2e+1	2.2e+1	3.4e+0	7.4e+0
67108879	250	125	1.2e+1	1.1e+2	3.8e+1	9.3e+0	6.5e+1	6.7e+1	NaN	NaN	NaN	NaN	1.0e+0	3.0e-1	5.1e+1	2.1e+1	3.4e+0	7.3e+0
67108879	1	250	8.6e-1	3.1e+1	1.9e+0	1.2e+0	2.9e+0	2.8e+0	NaN	NaN	NaN	NaN	1.0e+0	4.9e-1	2.1e+0	2.1e+0	1.7e+0	1.3e+0
67108879	250	1	7.2e-1	3.1e+1	1.8e+0	1.0e+0	2.7e+0	2.7e+0	NaN	NaN	NaN	NaN	1.0e+0	5.2e-1	2.0e+0	2.1e+0	1.7e+0	1.3e+0
67108879	500	500	2.6e+1	1.1e+2	6.8e+1	1.2e+1	8.3e+1	8.2e+1	3.3e+1	3.6e+1	3.5e+1	7.9e+0	1.0e+0	4.7e-1	9.5e+1	2.6e+1	3.4e+0	2.3e+1
67108879	250	500	1.6e+1	1.1e+2	6.7e+1	1.2e+1	8.3e+1	8.4e+1	NaN	NaN	NaN	NaN	1.0e+0	3.5e-1	8.8e+1	2.5e+1	3.3e+0	1.4e+1
67108879	500	250	1.6e+1	1.1e+2	6.4e+1	1.2e+1	8.3e+1	8.4e+1	NaN	NaN	NaN	NaN	1.0e+0	3.6e-1	9.0e+1	2.5e+1	3.4e+0	1.4e+1
67108879	1	500	1.2e+0	4.7e+1	2.5e+0	1.6e+0	4.7e+0	4.7e+0	NaN	NaN	NaN	NaN	1.1e+0	4.1e-1	2.9e+0	3.0e+0	2.0e+0	1.4e+0
67108879	500	1	9.4e-1	4.4e+1	2.5e+0	1.3e+0	4.1e+0	4.1e+0	NaN	NaN	NaN	NaN	1.0e+0	4.1e-1	2.9e+0	2.7e+0	1.9e+0	1.3e+0
67108879	1000	1000	4.2e+1	1.1e+2	7.4e+1	1.3e+1	7.6e+1	7.9e+1	4.4e+1	4.6e+1	4.6e+1	9.8e+0	1.0e+0	5.9e-1	9.7e+1	2.4e+1	3.0e+0	4.1e+1
67108879	500	1000	4.1e+1	1.1e+2	7.8e+1	1.3e+1	8.2e+1	8.3e+1	NaN	NaN	NaN	NaN	9.7e-1	5.0e-1	1.0e+2	2.4e+1	3.2e+0	3.8e+1
67108879	1000	500	4.2e+1	1.1e+2	7.7e+1	1.3e+1	8.2e+1	8.1e+1	NaN	NaN	NaN	NaN	1.0e+0	6.1e-1	9.8e+1	2.6e+1	3.3e+0	3.8e+1
67108879	1	1000	2.0e+0	6.5e+1	3.5e+0	2.6e+0	8.3e+0	8.3e+0	NaN	NaN	NaN	NaN	1.1e+0	3.4e-1	4.5e+0	4.2e+0	2.4e+0	1.6e+0
67108879	1000	1	1.3e+0	6.3e+1	3.4e+0	1.8e+0	7.0e+0	6.8e+0	NaN	NaN	NaN	NaN	1.0e+0	3.5e-1	4.2e+0	4.0e+0	2.3e+0	1.5e+0
67108879	2500	2500	7.1e+0	1.0e+2	1.1e+2	3.0e+0	1.1e+2	1.1e+2	3.8e+1	3.9e+1	3.8e+1	2.1e+0	1.0e+0	5.1e-1	4.3e+1	1.3e+1	3.2e+0	4.3e+0
67108879	1250	2500	2.5e+1	1.1e+2	4.7e+1	9.6e+0	4.9e+1	4.8e+1	NaN	NaN	NaN	NaN	1.0e+0	5.6e-1	6.7e+1	1.8e+1	3.4e+0	2.4e+1
67108879	2500	1250	2.6e+1	1.1e+2	4.6e+1	9.9e+0	4.9e+1	4.8e+1	NaN	NaN	NaN	NaN	1.0e+0	6.4e-1	6.6e+1	1.8e+1	3.4e+0	2.5e+1
67108879	1	2500	3.9e+0	8.4e+1	6.1e+0	4.7e+0	1.6e+1	1.6e+1	NaN	NaN	NaN	NaN	1.0e+0	2.8e-1	8.8e+0	7.2e+0	2.8e+0	2.2e+0
67108879	2500	1	2.2e+0	7.9e+1	5.3e+0	2.5e+0	1.0e+1	1.0e+1	NaN	NaN	NaN	NaN	9.9e-1	2.8e-1	7.5e+0	6.1e+0	2.6e+0	1.8e+0
67108879	5000	5000	3.9e+0	9.3e+1	1.4e+4	2.1e+0	2.4e+4	2.4e+4	6.0e+1	6.4e+1	6.1e+1	2.2e+0	1.0e+0	5.6e-1	3.0e+1	9.3e+0	2.9e+0	3.9e+0
67108879	2500	5000	3.8e+0	8.8e+1	8.7e+3	2.0e+0	1.7e+4	1.7e+4	NaN	NaN	NaN	NaN	1.1e+0	4.9e-1	2.9e+1	8.9e+0	2.9e+0	3.8e+0
67108879	5000	2500	3.8e+0	9.0e+1	8.0e+3	2.0e+0	1.5e+4	1.4e+4	NaN	NaN	NaN	NaN	1.1e+0	4.9e-1	2.9e+1	9.0e+0	2.9e+0	3.8e+0
67108879	1	5000	7.4e+0	9.5e+1	1.1e+1	7.0e+0	2.8e+1	2.9e+1	NaN	NaN	NaN	NaN	1.1e+0	2.7e-1	1.5e+1	1.0e+1	3.1e+0	3.0e+0
67108879	5000	1	2.9e+0	9.0e+1	7.8e+0	2.8e+0	1.4e+1	1.4e+1	NaN	NaN	NaN	NaN	9.8e-1	2.7e-1	1.1e+1	8.9e+0	2.8e+0	2.0e+0
67108879	10000	10000	3.0e+0	9.1e+1	4.4e+4	1.7e+0	6.7e+4	6.7e+4	1.1e+2	1.1e+2	1.1e+2	1.7e+0	1.0e+0	5.3e-1	3.0e+1	9.4e+0	2.9e+0	3.0e+0
67108879	5000	10000	3.0e+0	9.2e+1	3.1e+4	1.9e+0	5.4e+4	5.3e+4	NaN	NaN	NaN	NaN	1.1e+0	5.0e-1	2.9e+1	9.2e+0	2.9e+0	2.9e+0
67108879	10000	5000	3.0e+0	9.2e+1	2.7e+4	2.0e+0	4.3e+4	4.3e+4	NaN	NaN	NaN	NaN	1.1e+0	5.8e-1	3.0e+1	9.4e+0	2.9e+0	3.0e+0
67108879	1	10000	9.5e+0	1.0e+2	1.7e+1	8.4e+0	4.1e+1	4.1e+1	NaN	NaN	NaN	NaN	1.0e+0	2.6e-1	2.6e+1	1.5e+1	3.2e+0	4.0e+0
67108879	10000	1	3.7e+0	9.7e+1	1.1e+1	3.2e+0	1.7e+1	1.7e+1	NaN	NaN	NaN	NaN	1.0e+0	2.7e-1	1.6e+1	1.2e+1	2.9e+0	2.7e+0

modulus	rows	cols	copy	rd_mat	z_mat	cp_zero	()	(0)	idmat	(1)	(rd)	diag_rd	SEQ	FLAT	SP_001	SP_01	SP_1	MATRIX
94906265	5	5	5.6e-1	7.3e+0	1.2e+0	5.9e-1	8.4e-1	8.9e-1	1.1e+0	7.2e-1	6.8e-1	7.6e-1	1.0e+0	8.8e-1	1.3e+0	1.3e+0	1.3e+0	1.3e+0
94906265	2	5	5.6e-1	4.3e+0	1.3e+0	5.9e-1	7.9e-1	7.9e-1	NaN	NaN	NaN	NaN	1.0e+0	1.0e+0	1.2e+0	1.2e+0	1.2e+0	1.2e+0
94906265	5	2	5.4e-1	4.3e+0	1.3e+0	5.7e-1	7.9e-1	8.1e-1	NaN	NaN	NaN	NaN	1.0e+0	1.0e+0	1.2e+0	1.2e+0	1.3e+0	1.2e+0
94906265	1	5	5.4e-1	3.0e+0	1.3e+0	5.6e-1	7.8e-1	7.3e-1	NaN	NaN	NaN	NaN	9.9e-1	1.0e+0	1.2e+0	1.2e+0	1.2e+0	1.2e+0
94906265	5	1	5.3e-1	3.1e+0	1.3e+0	5.5e-1	7.5e-1	7.6e-1	NaN	NaN	NaN	NaN	9.8e-1	1.0e+0	1.2e+0	1.2e+0	1.2e+0	1.3e+0
94906265	10	10	7.5e-1	2.2e+1	1.4e+0	8.9e-1	1.4e+0	1.5e+0	1.3e+0	1.0e+0	1.0e+0	9.4e-1	1.0e+0	6.8e-1	1.6e+0	1.7e+0	1.5e+0	1.4e+0
94906265	5	10	5.9e-1	1.3e+1	1.5e+0	6.6e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	7.7e-1	1.4e+0	1.3e+0	1.4e+0	1.3e+0
94906265	10	5	5.9e-1	1.2e+1	1.4e+0	6.7e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	7.8e-1	1.4e+0	1.4e+0	1.3e+0	1.3e+0
94906265	1	10	5.3e-1	4.1e+0	1.3e+0	5.6e-1	8.2e-1	7.9e-1	NaN	NaN	NaN	NaN	1.0e+0	1.0e+0	1.2e+0	1.2e+0	1.3e+0	1.2e+0
94906265	10	1	5.3e-1	4.3e+0	1.3e+0	5.7e-1	7.8e-1	7.9e-1	NaN	NaN	NaN	NaN	1.0e+0	1.0e+0	1.2e+0	1.2e+0	1.2e+0	1.2e+0
94906265	25	25	1.4e+0	7.2e+1	2.5e+0	1.9e+0	4.5e+0	4.4e+0	1.8e+0	2.3e+0	2.3e+0	1.3e+0	1.0e+0	3.9e-1	3.6e+0	3.3e+0	2.2e+0	1.5e+0
94906265	12	25	9.3e-1	4.6e+1	2.1e+0	1.2e+0	3.3e+0	3.3e+0	NaN	NaN	NaN	NaN	1.0e+0	4.8e-1	2.3e+0	2.4e+0	1.8e+0	1.4e+0
94906265	25	12	9.2e-1	4.7e+1	2.1e+0	1.2e+0	3.3e+0	3.3e+0	NaN	NaN	NaN	NaN	1.0e+0	4.9e-1	2.4e+0	2.4e+0	1.9e+0	1.4e+0
94906265	1	25	5.5e-1	7.6e+0	1.3e+0	5.9e-1	8.9e-1	9.2e-1	NaN	NaN	NaN	NaN	1.0e+0	9.1e-1	1.2e+0	1.3e+0	1.3e+0	1.3e+0
94906265	25	1	5.5e-1	7.5e+0	1.4e+0	5.8e-1	9.0e-1	9.0e-1	NaN	NaN	NaN	NaN	9.8e-1	9.0e-1	1.3e+0	1.3e+0	1.3e+0	1.3e+0
94906265	50	50	3.8e+0	1.1e+2	5.8e+0	4.4e+0	1.3e+1	1.3e+1	3.7e+0	5.0e+0	5.3e+0	2.0e+0	9.9e-1	3.2e-1	9.5e+0	7.9e+0	2.9e+0	2.3e+0
94906265	25	50	2.2e+0	9.5e+1	4.3e+0	2.9e+0	1.0e+1	1.0e+1	NaN	NaN	NaN	NaN	1.0e+0	3.4e-1	5.6e+0	5.0e+0	2.6e+0	1.8e+0
94906265	50	25	2.2e+0	9.4e+1	4.3e+0	2.9e+0	9.8e+0	9.9e+0	NaN	NaN	NaN	NaN	1.0e+0	3.3e-1	5.6e+0	5.1e+0	2.6e+0	1.8e+0
94906265	1	50	5.8e-1	1.2e+1	1.4e+0	6.4e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	1.0e+0	7.8e-1	1.3e+0	1.4e+0	1.3e+0	1.3e+0
94906265	50	1	5.5e-1	1.3e+1	1.4e+0	6.3e-1	1.1e+0	1.1e+0	NaN	NaN	NaN	NaN	9.9e-1	7.6e-1	1.4e+0	1.4e+0	1.3e+0	1.3e+0
94906265	100	100	1.0e+1	1.4e+2	1.6e+1	8.2e+0	3.3e+1	3.2e+1	8.1e+0	1.0e+1	1.1e+1	3.1e+0	1.0e+0	3.2e-1	2.7e+1	1.5e+1	3.2e+0	4.1e+0
94906265	50	100	7.2e+0	1.2e+2	1.2e+1	6.6e+0	2.9e+1	2.9e+1	NaN	NaN	NaN	NaN	1.0e+0	3.2e-1	1.6e+1	1.1e+1	3.1e+0	3.0e+0
94906265	100	50	7.0e+0	1.3e+2	1.1e+1	6.7e+0	2.8e+1	2.8e+1	NaN	NaN	NaN	NaN	1.1e+0	3.1e-1	1.6e+1	1.1e+1	3.2e+0	3.0e+0
94906265	1	100	7.1e-1	2.2e+1	1.5e+0	8.5e-1	1.6e+0	1.6e+0	NaN	NaN	NaN	NaN	1.1e+0	6.7e-1	1.6e+0	1.6e+0	1.4e+0	1.3e+0
94906265	100	1	6.9e-1	2.1e+1	1.5e+0	7.9e-1	1.5e+0	1.5e+0	NaN	NaN	NaN	NaN	1.0e+0	6.7e-1	1.6e+0	1.6e+0	1.5e+0	1.3e+0
94906265	250	250	1.3e+1	1.4e+2	4.8e+1	9.9e+0	7.0e+1	7.0e+1	2.1e+1	2.4e+1	2.4e+1	5.1e+0	1.0e+0	3.2e-1	7.3e+1	2.4e+1	3.4e+0	9.9e+0
94906265	125	250	1.2e+1	1.4e+2	3.8e+1	9.7e+0	6.7e+1	6.8e+1	NaN	NaN	NaN	NaN	1.0e+0	3.4e-1	5.4e+1	2.2e+1	3.4e+0	7.4e+0
94906265	250	125	1.2e+1	1.4e+2	3.9e+1	9.2e+0	6.7e+1	6.6e+1	NaN	NaN	NaN	NaN	1.0e+0	3.1e-1	5.2e+1	2.3e+1	3.5e+0	7.3e+0
94906265	1	250	8.4e-1	4.1e+1	2.0e+0	1.2e+0	2.8e+0	2.9e+0	NaN	NaN	NaN	NaN	1.0e+0	4.9e-1	2.2e+0	2.2e+0	1.8e+0	1.3e+0
94906265	250	1	7.4e-1	4.0e+1	1.9e+0	9.8e-1	2.6e+0	2.7e+0	NaN	NaN	NaN	NaN	9.9e-1	4.9e-1	2.2e+0	2.1e+0	1.8e+0	1.3e+0
94906265	500	500	2.7e+1	1.4e+2	7.1e+1	1.2e+1	8.0e+1	8.1e+1	3.6e+1	3.7e+1	3.8e+1	7.9e+0	1.0e+0	5.0e-1	1.0e+2	2.6e+1	3.5e+0	2.4e+1
94906265	250	500	1.7e+1	1.5e+2	6.8e+1	1.2e+1	8.6e+1	8.6e+1	NaN	NaN	NaN	NaN	1.1e+0	3.5e-1	9.0e+1	2.6e+1	3.5e+0	1.4e+1
94906265	500	250	1.6e+1	1.5e+2	6.9e+1	1.2e+1	8.4e+1	8.5e+1	NaN	NaN	NaN	NaN	1.0e+0	3.8e-1	9.0e+1	2.6e+1	3.5e+0	1.4e+1
94906265	1	500	1.2e+0	6.4e+1	2.6e+0	1.7e+0	4.7e+0	4.8e+0	NaN	NaN	NaN	NaN	1.0e+0	4.1e-1	3.0e+0	2.8e+0	2.1e+0	1.4e+0
94906265	500	1	1.0e+0	6.1e+1	2.4e+0	1.4e+0	4.2e+0	4.2e+0	NaN	NaN	NaN	NaN	1.0e+0	3.9e-1	3.0e+0	2.7e+0	2.1e+0	1.3e+0
94906265	1000	1000	4.2e+1	1.5e+2	7.0e+1	1.3e+1	7.6e+1	7.5e+1	4.6e+1	4.8e+1	4.7e+1	9.6e+0	1.0e+0	6.5e-1	9.8e+1	2.5e+1	3.1e+0	4.2e+1
94906265	500	1000	4.3e+1	1.4e+2	7.8e+1	1.3e+1	8.1e+1	8.1e+1	NaN	NaN	NaN	NaN	1.0e+0	5.5e-1	1.0e+2	2.6e+1	3.5e+0	3.9e+1
94906265	1000	500	4.3e+1	1.4e+2	7.7e+1	1.3e+1	8.2e+1	8.2e+1	NaN	NaN	NaN	NaN	1.0e+0	6.3e-1	1.1e+2	2.7e+1	3.4e+0	3.9e+1
94906265	1	1000	2.0e+0	9.0e+1	3.7e+0	2.6e+0	8.3e+0	8.5e+0	NaN	NaN	NaN	NaN	1.0e+0	3.4e-1	4.8e+0	4.2e+0	2.4e+0	1.7e+0
94906265	1000	1	1.4e+0	8.6e+1	3.4e+0	1.9e+0	6.6e+0	6.5e+0	NaN	NaN	NaN	NaN	1.0e+0	3.3e-1	4.5e+0	4.1e+0	2.3e+0	1.5e+0
94906265	2500	2500	7.8e+0	1.3e+2	1.1e+2	3.6e+0	1.1e+2	1.2e+2	3.8e+1	3.8e+1	3.9e+1	2.0e+0	1.0e+0	5.4e-1	4.5e+1	1.3e+1	3.3e+0	4.3e+0
94906265	1250	2500	2.5e+1	1.4e+2	4.7e+1	1.0e+1	4.8e+1	4.8e+1	NaN	NaN	NaN	NaN	1.0e+0	5.6e-1	6.7e+1	1.8e+1	3.6e+0	2.5e+1
94906265	2500	1250	2.5e+1	1.4e+2	4.7e+1	9.3e+0	4.9e+1	4.8e+1	NaN	NaN	NaN	NaN	1.0e+0	6.4e-1	6.8e+1	1.8e+1	3.4e+0	2.4e+1
94906265	1	2500	3.7e+0	1.1e+2	6.4e+0	4.7e+0	1.6e+1	1.6e+1	NaN	NaN	NaN	NaN	1.0e+0	3.0e-1	9.2e+0	7.4e+0	3.0e+0	2.3e+0
94906265	2500	1	2.1e+0	1.1e+2	5.5e+0	2.5e+0	1.0e+1	1.0e+1	NaN	NaN	NaN	NaN	1.0e+0	3.1e-1	8.0e+0	6.6e+0	2.7e+0	1.9e+0
94906265	5000	5000	3.9e+0	1.3e+2	1.4e+4	2.1e+0	2.4e+4	2.4e+4	6.2e+1	6.0e+1	6.1e+1	2.2e+0	1.0e+0	5.6e-1	3.0e+1	9.2e+0	3.0e+0	4.0e+0
94906265	2500	5000	3.8e+0	1.2e+2	9.2e+3	2.0e+0	1.7e+4	1.7e+4	NaN	NaN	NaN	NaN	1.0e+0	4.9e-1	2.9e+1	8.9e+0	2.9e+0	3.8e+0
94906265	5000	2500	3.8e+0	1.2e+2	8.3e+3	2.0e+0	1.5e+4	1.5e+4	NaN	NaN	NaN	NaN	1.0e+0	5.1e-1	2.9e+1	8.9e+0	2.9e+0	3.8e+0
94906265	1	5000	7.2e+0	1.3e+2	1.1e+1	7.1e+0	2.9e+1	2.9e+1	NaN	NaN	NaN	NaN	1.0e+0	2.8e-1	1.6e+1	1.2e+1	3.1e+0	3.1e+0
94906265	5000	1	3.0e+0	1.2e+2	8.0e+0	2.9e+0	1.4e+1	1.4e+1	NaN	NaN	NaN	NaN	1.0e+0	2.8e-1	1.2e+1	9.3e+0	3.1e+0	2.1e+0
94906265	10000	10000	3.0e+0	1.2e+2	4.5e+4	1.6e+0	6.6e+4	6.5e+4	1.2e+2	1.2e+2	1.2e+2	1.6e+0	1.0e+0	5.7e-1	3.0e+1	1.0e+1	3.1e+0	3.0e+0
94906265	5000	10000	3.0e+0	1.2e+2	3.2e+4	2.0e+0	5.3e+4	5.3e+4	NaN	NaN	NaN	NaN	1.0e+0	5.3e-1	3.0e+1	9.5e+0	3.0e+0	2.9e+0
94906265	10000	5000	3.0e+0	1.2e+2	2.7e+4	2.0e+0	4.1e+4	4.0e+4	NaN	NaN	NaN	NaN	1.0e+0	5.7e-1	3.0e+1	9.5e+0	2.9e+0	2.9e+0
94906265	1	10000	9.6e+0	1.3e+2	1.8e+1	8.4e+0	4.0e+1	4.0e+1	NaN	NaN	NaN	NaN	1.0e+0	2.7e-1	2.6e+1	1.5e+1	3.2e+0	4.4e+0
94906265	10000	1	3.7e+0	1.3e+2	1.1e+1	3.2e+0	1.7e+1	1.7e+1	NaN	NaN	NaN	NaN	1.0e+0	2.8e-1	1.7e+1	1.1e+1	3.0e+0	2.7e+0

GSoC Project proposal 2023

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Background

I am currently in my second year of a double bachelor in Mathematics and CS. As such, I have followed and am following undergraduate courses in Linear Algebra, Algorithmic and Discrete Math in which I feel comfortable. I have also learned to program in C and Python.

I do not have any pet projects, and until very recently, I had never contributed to large-scale open-source projects. In the last few months, I got acquainted with SageMath (a natural tool in my field of study) and learned about its development process. I have recently made a pull request for some improvements in the documentation (#35431) and I am currently working on another pull request for solving a minor issue (#33921).
I am looking forward to learn and expand my knowledge.

For now, SageMath is built on a Linux distribution (Debian 11) through a virtual machine. I will soon receive a more perfoming computer on which I will not need to resort to a virtual machine, which will allow a more comfortable development framework and more reliable observations on performance aspects.

Project

Project idea suggested by the organization (SageMath) : **Enhancements in linear algebra.**
Mentors : Vincent Neiger and Clement Pernet
Length : 350 hours

The project described on the organization webpage is as follows :

Sage incorporates state-of-the-art libraries for exact linear algebra computations, such as matrix multiplication, reduced echelon form, linear system solving, when the coefficients are in an exact domain such as the integers or finite fields.

However, several aspects make the integration of these libraries not yet fully satisfactory. For example, working over a prime field with a prime below about 20 bits, the mere creation of a zero matrix in SageMath takes roughly as long as the call of the underlying fast reduced echelon form procedure (performed by LinBox / FFLAS-FFPACK in this case). Still about FFLAS-FFPACK: several available tools in this library are not offered through the Sage interface, constraining the user experience; for example, some pivoting strategies are not available, despite their usefulness in some situations e.g. when one is interested in the preservation of some rank profile properties. Finally, the integration of linear algebra implementations from Flint has been initiated, with a good amount of work already done, but is not fully finalized ans has not been merged into Sage.

This project aims to make this kind of enhancements, which would lead to more efficient and more versatile finite field linear algebra operations in Sage.

Comments and additions/extensions of the project

− Zero matrix creation:

I have verified that the creation of large zero matrices (over prime finite fields with machine word size modulus) indeed takes a long time. In fact, this is not specific to zero matrices, but seems to concern any matrix copy or construction, which makes this even more problematic: for example the same phenomenon arises each time one takes a submatrix of an already created matrix. On the positive side, this happens for the first creation only: if we create several matrices with the same dimensions, only the first one is long to create. This seems to suggest that the time is spent on, at the first creation, preparing some cached data related to the considered matrix space. Nevertheless, this remains a critical performance issue when one designs an algorithm which manipulates several (sub)matrices of different dimensions.

− Choosing between FFLAS-FFPACK and LinBox:

Currently, SageMath calls FFLAS-FFPACK for some operations, and LinBox for others. It is not immediately clear to me where these choices come from, especially in the case of these prime fields where it seems that FFLAS-FFPACK should be preferred anywhere possible.

− Providing more tools already in FFLAS-FFPACK:

As noted in the project idea, FFLAS-FFPACK offers several strategies for different types of LU factorizations. In the code for echelon forms I found methods for ”PLUQ” factorization and for ”LUdivine” factorization. The current SageMath code forces the use of the latter. Upon contacting the planned mentors for this project they informed me that it is precisely this kind of choice that may prevent one from getting wanted rank profile properties. In addition to offering more choices in SageMath (that are already implemented in FFLAS-FFPACK), the mentors also explained that we could also provide functionalities to compute the rank profile matrix, a recently highlighted invariant that is easily deduced from the PLUQ factorization.

− LU method of SageMath:

My experiments have showed that the LU method in SageMath is much slower than the echelon form (except for very small matrices), when working over a prime field as written above. For example, for 300 x 300 matrices, 9.8 seconds for LU versus less than 30 milliseconds for the echelon form. The echelon form is calling fast libraries (FFLAS-FFPACK / LinBox). Yet, as far as I could understand from the SageMath code, it seems that the LU method is a general method for all fields, written in python/cython. It would be interesting to see how to improve this by calling FFLAS-FFPACK routines. At least, the documentation.

− Sparse matrices:

This is not mentioned in the above project idea, but I thought this would be an interesting enhancement of SageMath’s linear algebra over prime fields. When going through the FFLAS-FFPACK code I have noticed that there are some tools specific for sparse linear algebra. Yet, when I tried basic operations in SageMath, my impression was that this is not using such high-performance implementations. For example, building in SageMath a large sparse matrix (10000 x 10000, density 0.01) over a prime field, and measuring the time for a matrix-vector product, I obtained performances that were much worse than by making the same matrix-vector product but with a random dense matrix of the same dimensions (the timing difference was of several orders of magnitude). I am interested in analyzing this further, reading the relevant piece of the SageMath code to see how sparse matrices are currently implemented, and working on enhancing sparse matrix computations in SageMath if the mentors consider that this is feasible within the scope of this project.

− Flint:

I have not yet looked at the Flint library and its integration into SageMath, but will do so before and during the bonding period.

Tentative schedule

April 4 - May 4 : Post-application period (personal work)

· Learn general conventions and semantics for Sage development;

· Continue the exploration of SageMath’s reference manual and of its linear algebra implementations;

· Continue to identify more precisely where the targeted issues come from;

· Note possible improvements and their bounds.

May 4 - May 28 : Community Bonding

- Regular meetings and discussions with the mentors;
- Discuss what I have found until now and the project comments and extensions listed above;
- Discuss and refine the tentative schedule.

May 28 - July 13 : 1st phase

Main objectives : ensure fast creation of matrices and submatrices; get complete overview of the integration tasks to be implemented in phase 2.

Tasks:

- Improvement of performance for the creation of matrices/submatrices;
- Study the possibility of offering computations on submatrices without creating copies;
- Analyze what tools are available in FFLAS-FFPACK, LinBox, Flint, how they compare to each other in terms of functionality and performance, and which ones are already integrated in SageMath;
- In particular, study whether the LU method of SageMath could rely on one of these fast libraries;
- Start integrating tools from these fast libraries, depending on the outcomes of the last three points;
- Start the study of pivoting strategies for Gaussian elimination, and their properties.

July 14 - August 21 : 2nd phase

Main objectives : ensure the complete integration in SageMath of LU-type factorizations and echelonization procedures from the existing state-of-the-art libraries; initialize the integration of sparse linear algebra.

Tasks:

- Start the study of what could be integrated from the sparse linear algebra support in FFLAS-FFPACK;
- Continue the work on enhancing and augmenting the integration of dense linear algebra tools from FFLAS-FFPACK, LinBox, and Flint;
- Decide which pivoting strategies available in FFLAS-FFPACK/LinBox could be integrated, and do this integration;
- Integrate selected sparse linear algebra tools from FFLAS-FFPACK.

August 21 - September 4 : Final phase

- Finalize the work product;
- Perform a global check of the documentation and tests added through the enhancements brought by the project;
- Submit final work product and final mentor evaluation.

Risk management

An organizational risk is related to my course schedules. Indeed, from July 13th I will be able to devote all my time to this project, yet until this date I will have an additional workload coming from the last weeks of some undergraduate courses. This course workload is sufficiently low so that conducting this project at the same time is feasible, but this will require good work organization.

The main risk, which is not easy to estimate right now, is due to the fact that I am only at undergraduate level currently. Although I have learned about basic linear algebra, for example the subtle differences between different approaches mentioned above for choosing pivots in LU factorization, or the rank profile matrix, or the algorithms specific to sparse matrices, are new to me. Therefore, some of the planned activities and objectives could take much more time than expected due to some new notion that I need to learn, or some implementation aspects that I have not encountered before.

For controlling this risk, and generally to ensure that the project stays on good tracks at all times despite possible unexpected circumstances, it will be essential to keep a frequent communication with my mentors, discussing all aspects of the project including organizational ones.

Early finish: in case the tentative schedule is handled faster than expected, there seems to be sufficiently many paths for extending the project, so as to avoid the risk of having nothing to do in the last week of the project.