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Representation of Heterogeneous Tessellation Structures by Graphs

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Abstract Tables are widely used in documentation. We consider in this paper the representation of tables in consideration of drawing problem of tables. While, it is commonly regarded that processing systems are more elegantly constructed on graphs rather than on other geometric objects.
We first introduce a simple model of tables with cells of heterogeneous sizes, which model represents the sizes of cells and the location of each cell. Then we introduce certain class of graphs and corresponding relations between the graphs and the tables. It is shown that there is one to one mapping between the graphs and the tables.

Keywords and phrases
Tabular forms, graph grammars, tessellation structures

1. INTRUDUCTION

Tables are widely used in documentation. Most of documentation processing systems control tables under naive representation. In those processing systems, tables are not considered in their structures. So, locations of cells in tables are not inherited but from neighboring cells, while the drawing of tables. We consider in this paper the representation of tables in consideration with drawing problems of tables.

While, it is widely considered that processing systems are more elegantly constructed on graphs rather than on other geometric objects. So, we provide another representation method, in which the drawing problems are smoothly achieved, by certain types of graphs.

We first introduce a simple set model of tables with cells of heterogeneous sizes, which represents sizes of the cells and the absolute location of each cell. We note that in these set notations of tables, cells and their neighboring cells are not generally located in neighboring positions. This property may cause higher computational complexity in the rewriting and the transformation of tables in the table design.

Then we introduce a certain class of graphs and a corresponding relation between the graphs and the tables. It is shown that there is one to one mapping between the graphs and the tables. Those objects such as tables are considered by graphs with the corresponding relation.

2. DEFINITIONS OF TABLES

Definition. An (n, m)-*support* is a set $\{(i, j) \mid 1 =< i =< n, 1 =< j =< m\}$ of integer pairs. A *support* is a (n, m)-support for some n and m.

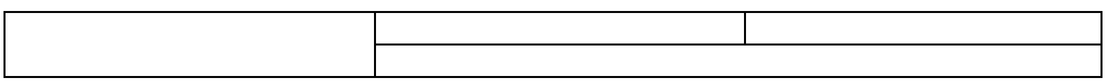
For (n, m)-support, the *row location* is a map *loc-lrow* from rows $\{1, 2, ..., n\}$ to R. The *column location* is a map *loc-column* from columns $\{1, 2, ..., m\}$ to R. The *location* is a tuple (loc-row, loc-column, O), where O in R denotes the left upper most location of the (*n*, *m*)-support. A *partial support* is a subset *P* of an (*n*, *m*)-support, where *P* is of the form {(*i*, *j*) | *k* <= *i* <= *l*, *s* <= *j* <= *t*} for some integers *k*, *l*, *s*, *t*.

Definition. A *support partition P over a support S* is a pair wise disjoint set {S_1, S_2, ..., S_N} of partial supports, where S_1 ¥cup S_2 ¥cup ... ¥cup S_N = *S*. A *table over a support S* is a tuple (*S*, *P*, *loc*} of a support *S*, a support partition *P* over *S* and the location *loc* of *S*.

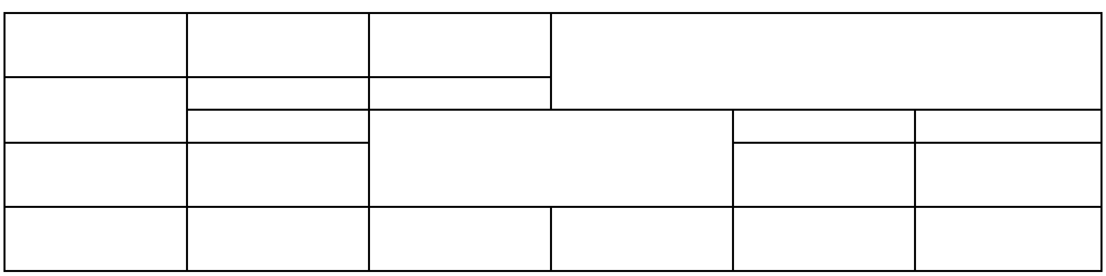
Each partial support is called by a *cell*.

<u>*Location*</u> of each cell *c* = is defined by:
<u>*Ceiling*</u> (north wall) of *c* is *max i* - 1 ...
<u>*Floor*</u> (*south wall*) of *c* is *min i* ...
<u>*Left wall*</u> (*west wall*) of *c* is *min j* - 1 ...
<u>*Right wall*</u> (*east wall*) of *c* is *max j* ...

Example 1. A Support partition
The following figure denotes a support partition {{(1,1), (2,1)}, {(1, 2)}, {(1, 3)}, {(2, 2), (2, 3)}} over (2, 3)-support.



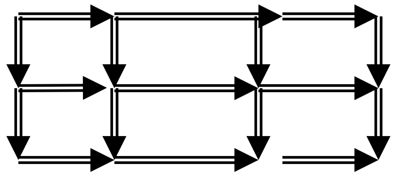
Example 2. Another support partition.

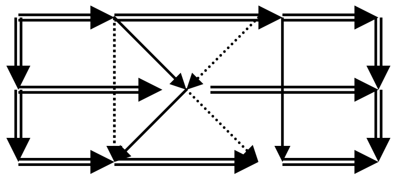


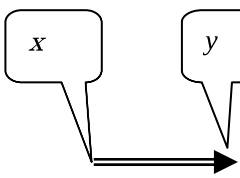
We note that in these set notations of tables, neighboring cells are not generally located in neighboring positions. So, the rewriting and the transformation related to neighboring cells may need the rewriting and the transformation of cells located far from the target cell in these set notation. Thus, these set notations may cause higher computational complexity in the rewriting and the transformation systems. Next section provides another notation of tables by graphs, in which neighboring cells located in neighboring positions in graph theoretic sense.

3. TABLES AND QUASI TESSELLATION GRAPHS

Next figures show the representation rules (below), tables (upper right) and the corresponding *quasi tessellation graphs* (upper left) derived with the representation rules.



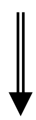




North wall and south wall coordinates are same of *x* and *y*

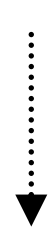
North wall coordinates are same of *x* and *y*

South wall coordinates are same of *x* and *y*



East wall and west wall coordinates are same of *x* and *y*

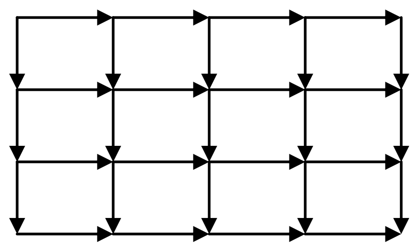
West wall coordinates are same of *x* and *y*



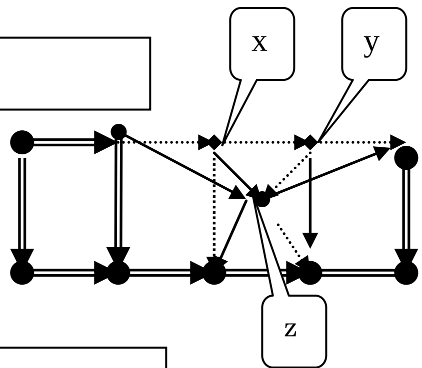
East wall coordinates are same of x and y

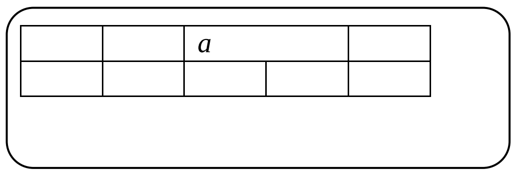
Example 3. Peripheral cells and corresponding nodes

Cell *a* is represented by node *z*
Ceiling of the cell *a* is represented by node *x* and *y*
Virtual cells *x* and *y* has no valid heights
Ceiling of the cell *z* is covered by cells *x* and *y*

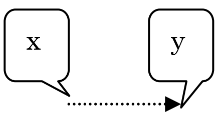


example

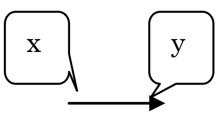




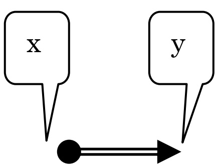
General rules



Cells *x* and *y* are of same ceiling coordinates

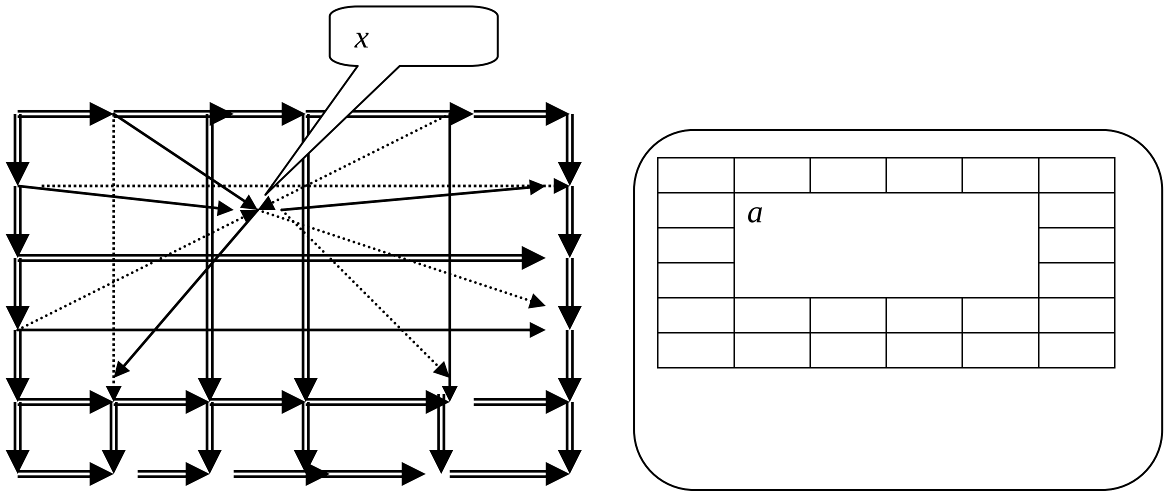


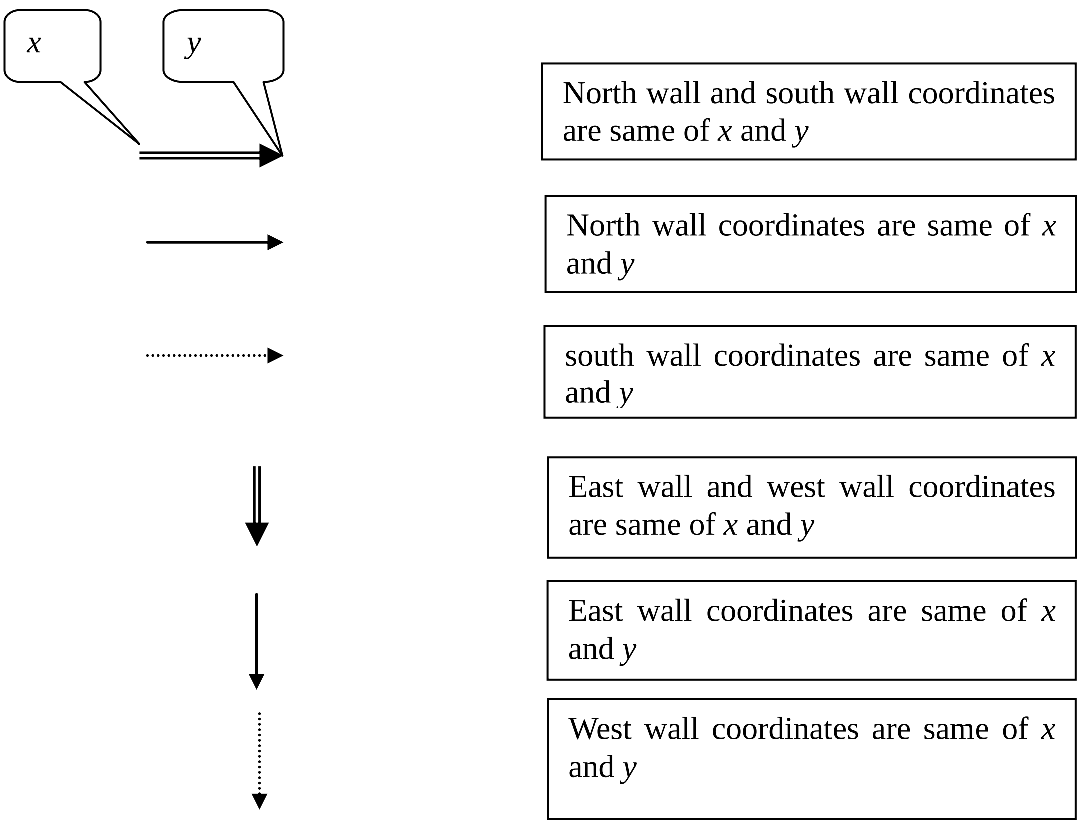
Cells *x* and *y* are of same floor coordinates



Cells *x* and *y* are of same ceiling and floor coordinates

Example 4. A table and its corresponding quasi tessellation graph
A large inner cell and its corresponding node.
The cell *a* is represented by the node *x*.





Re-formatted and typo corrected from the original version on June 21, 2012
Remark 1. "The quasi tessellation graphs" are called "the octgrids" in later studies.
Remark 2. The descriptions in Example 3 on Page 4 are changed in later studies.