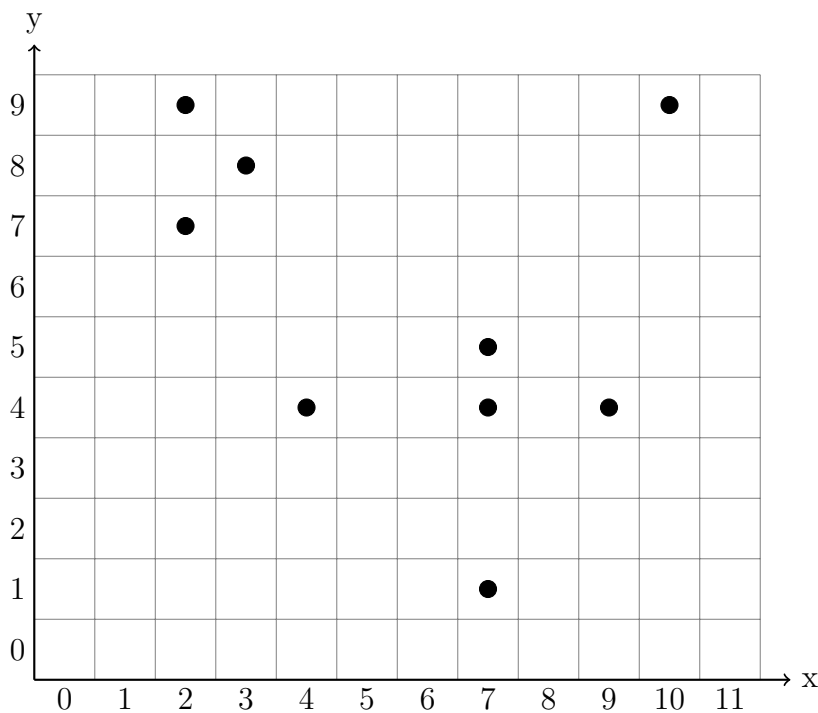


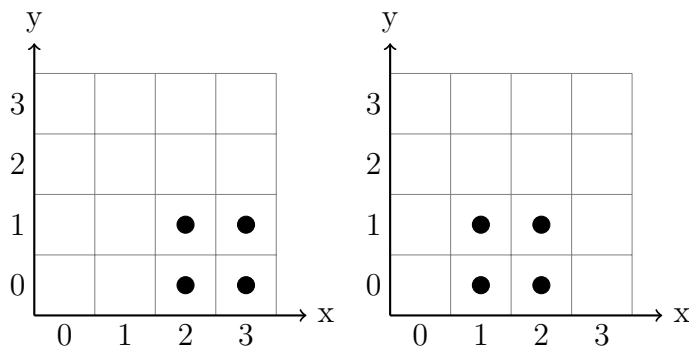
Temporal and Spatial Data Management

Exercise Series 5

Task 5.1: Consider the following database instance with 2D points. Construct a kD-tree for this instance if a leaf page has a capacity of 2.



Task 5.2: Give an SQL query that retrieves the points shown in the figure below. Assume the area is indexed with a z-curve.



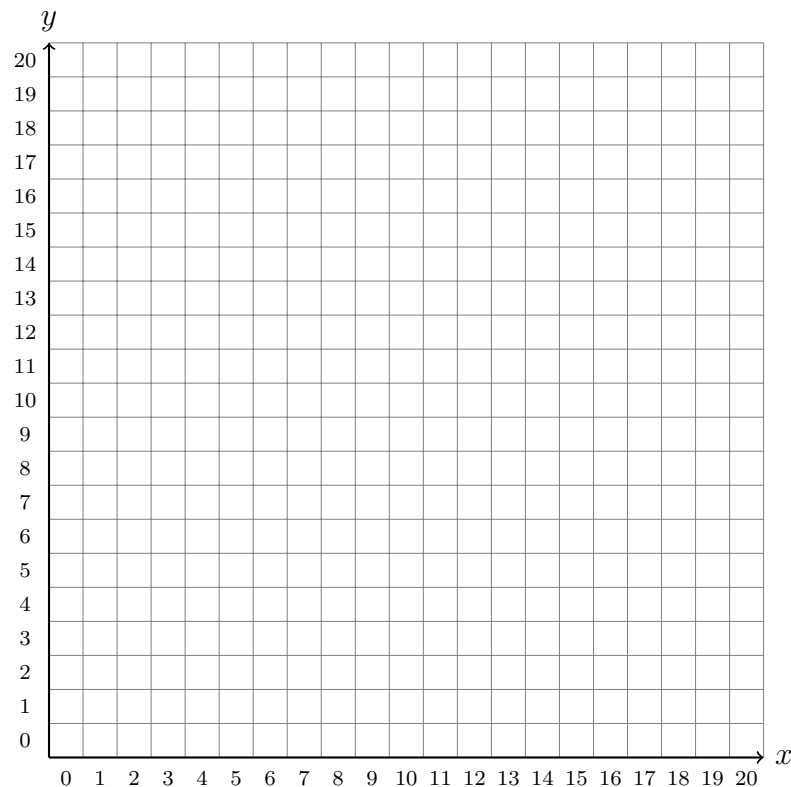
Task 5.3: Which is the main factor that limits the scalability of grid files.

Task 5.4: Analyze and discuss the following options for the design of spatial types. List advantages and disadvantages.

1. Assume a spatial algebra offers *regions* as the only spatial data type. Discuss and assess this choice.
2. Assume a spatial algebra defines the following three spatial data types: *points*, *lines*, *polygons*.

Task 5.5: Consider the following relation together with query point $QP = 13$ and query interval $QI = [5,6]$.

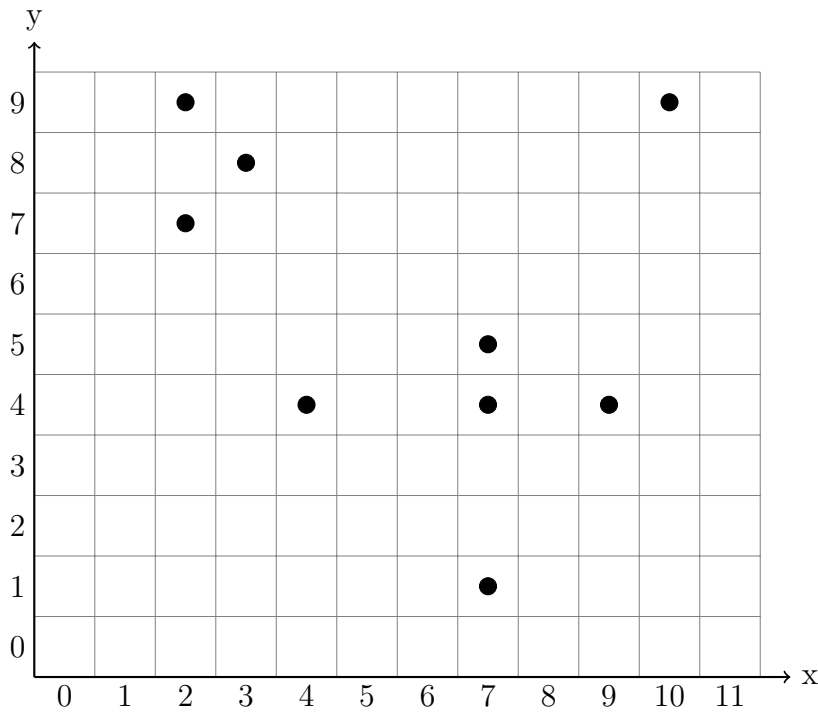
r	
A	T
a	[2,9]
b	[8,14]
c	[12,19]
d	[5,7]



Assume intervals are transformed to a two-dimensional parameter space. Illustrate the database in the parameter space. Give relational algebra expression that answer a *point query*, an *intersection query*, a *containment query*, and an *enclosure query* in the parameter space.

Task 5.6: Compare the fanout of a B-tree and an R-tree. Discuss what happens if you use an R-tree to index high-dimensional data.

Task 5.7: Consider the following database instance with 2D points. Construct an R-tree for this instance. Assume a page capacity of 3.



Task 5.8: Consider an 8x8 grid and a z-order encoding. Identify a region that does not preserve the proximity. What would be a good approach to retrieve objects that overlap the area?

