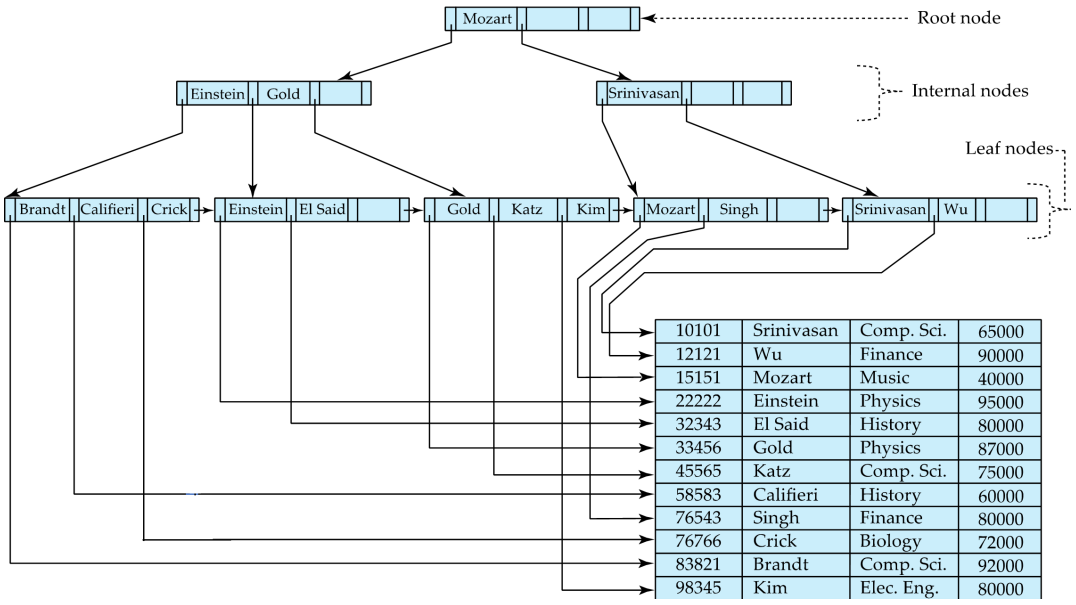
Exercise 3

1. What indices are suitable if a table is frequently used for finding records based on three criteria: a list of users' name, a range of users' birthday and a spatial region covering users' residence?
2. Review the points on indexing with $B+$ trees. Assume a database table has 10,000,000 records and the index is built with a $B+$ tree. The maximum number of children of a node, is denoted as n. How many steps are needed to find a record if $n = 4$? How many steps are needed to find a record if $n = 100$?
3. Given the database table (shown below), build a bitmap index for the 'State' attribute.

Record Num	Name	State	Income_level
0	John	VIC	L1
1	Diana	NSW	L2
2	Xiaolu	WA	L1
3	Anil	VIC	L4
4	Peter	NSW	L3

4. Given the B+tree example below please search for "Crick" by going through the search algorithm from our lectures step by step.



5. In the following figure, the rectangles A-I are data objects. These data objects are indexed using an R-tree, where BB1-BB3 denote bounding boxes. Given a query point location denoted as 'i' in the figure, traverse the nodes of the R-tree below in a best-first manner (that is, retrieve the node with the shortest distance from 'i' in each iteration) as discussed in class to find the 1st nearest neighbour of query point "i". If 'i' is inside a bounding box (or rectangle), the distance from i to that bounding box is zero. If there are more than one bounding boxes (or rectangles) with the same distance from i, choose the one alphabetically (e.g., i is inside both BB1 and BB3, choose BB1 first). Is there anything peculiar that you notice while traversing an R-tree?

   [Note: Consider the distances just visually].