

## IMPLEMENTATION NOTES FOR LAB EXERCISE 5

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### LAB 5 – B-TREE FOR MICROFINANCE LOAN AND CUSTOMER MANAGEMENT

This system implements a B-tree data structure to manage customer records and loan information for a microfinance institution. The implementation provides efficient searching and insertion of customer records with associated loan information.

#### Pseudocodes Of Core Operations

##### **Insert Operations:**

FUNCTION insert(customer\_record):

    IF root is full THEN

        Create new root

        Split old root

        Insert into appropriate child

    ELSE

        Insert into non-full node

FUNCTION insert\_non\_full(node, record):

    IF node is leaf THEN

        Insert record in sorted position

    ELSE

        Find appropriate child

        IF child is full THEN

            Split child

            Determine which child to follow

        Recursively insert into child

##### **Search Operation:**

FUNCTION search(customer\_id):

    Start at root

    WHILE node not null:

        Find position of key in current node

        IF key found THEN

            Return associated customer record

        IF leaf node THEN

            Return null

    ELSE

        Move to appropriate child node

    Return null

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### Node Split Operation:

FUNCTION split\_child(parent, index):

- Create new node
- Move median key to parent
- Split existing keys between nodes
- IF not leaf THEN
  - Split children between nodes
- Update parent's children

### Test Data Generation:

FUNCTION create\_dummy\_data(loan\_count, customer\_count):

- Initialize empty B-tree

- FOR i = 1 to loan\_count:

- Create loan with random:

- amount (500-5000)
    - interest rate (0-1)
    - term (1-48 months)

- FOR i = 1 to customer\_count:

- Create customer with:

- ID (100 + i)
    - Random name combination
    - Random location
    - Random credit score (500-1000)

- Assign random loans

- Insert into B-tree

- Return B-tree

### Core Components

#### 1. **BTreeNode**

Represents a node in the B-tree and it is used to store customer records and child node references.

#### 2. **CustomerRecord**

Stores customer information including ID, name, location, credit score. It contains a list of associated loan records

#### 3. **LoanRecord**

Manages loan information including amount, interest rate, term, and status. Loan records are associated with specific customers

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### System Constraints

#### 1. Customer IDs

- Must be unique integers
- Range: 100 and above
- Used as keys in the B-tree

#### 2. Loan Parameters

- Amount: 500 to 5000 (currency units)
- Interest Rate: 0 to 1 (0% to 100%)
- Term: 1 to 48 months (4 years maximum)
- Status: Currently only "Active" status implemented

#### 3. Credit Scores

- Range: 500 to 1000
- Higher scores indicate better creditworthiness

#### 4. B-tree Properties

- Minimum degree ( $t$ ) = 3
- Each node can have 2 to 5 keys
- All leaf nodes must be at same level

#### 5. Memory Management

- All data stored in memory
- No persistent storage implemented