Franklin Jefferson University

Programming Competency Test

Instructions to follow:

- ➔ Time duration : 4 hours
- ➔ Scoring is based on
  - ◆ **Correctness** verified using test cases
  - ◆ **Efficiency** verified verified using test cases
  - ◆ **Elegance** verified via code review

Computer Science Programming and Principles - I

Write a program to calculate nth Ramanujan number. (In a programming language of your choice)

Computer Science Programming and Principles - II

Write a Java program to implement a String abstract data type (DO NOT use the String class from the Java API) with the following methods:

1. charAt(int index): Returns the character at the given index of char[].
2. concat(char[] str): Concatenates the given char[] to the calling Object's char[] and returns a concatenated char[].
3. split(char[] delimiter): Splits the given char[] into a char[][] based on the method argument char[] as delimiter.

Algorithms and Data Structures - Part 1

Write a Java program with a method **isBST()** that takes a Node as argument and returns true if the argument node is the root of a binary search tree, false otherwise.

Algorithms and Data Structures - Part 2

Write a Java program to find the longest common subsequence for the given two sequences.

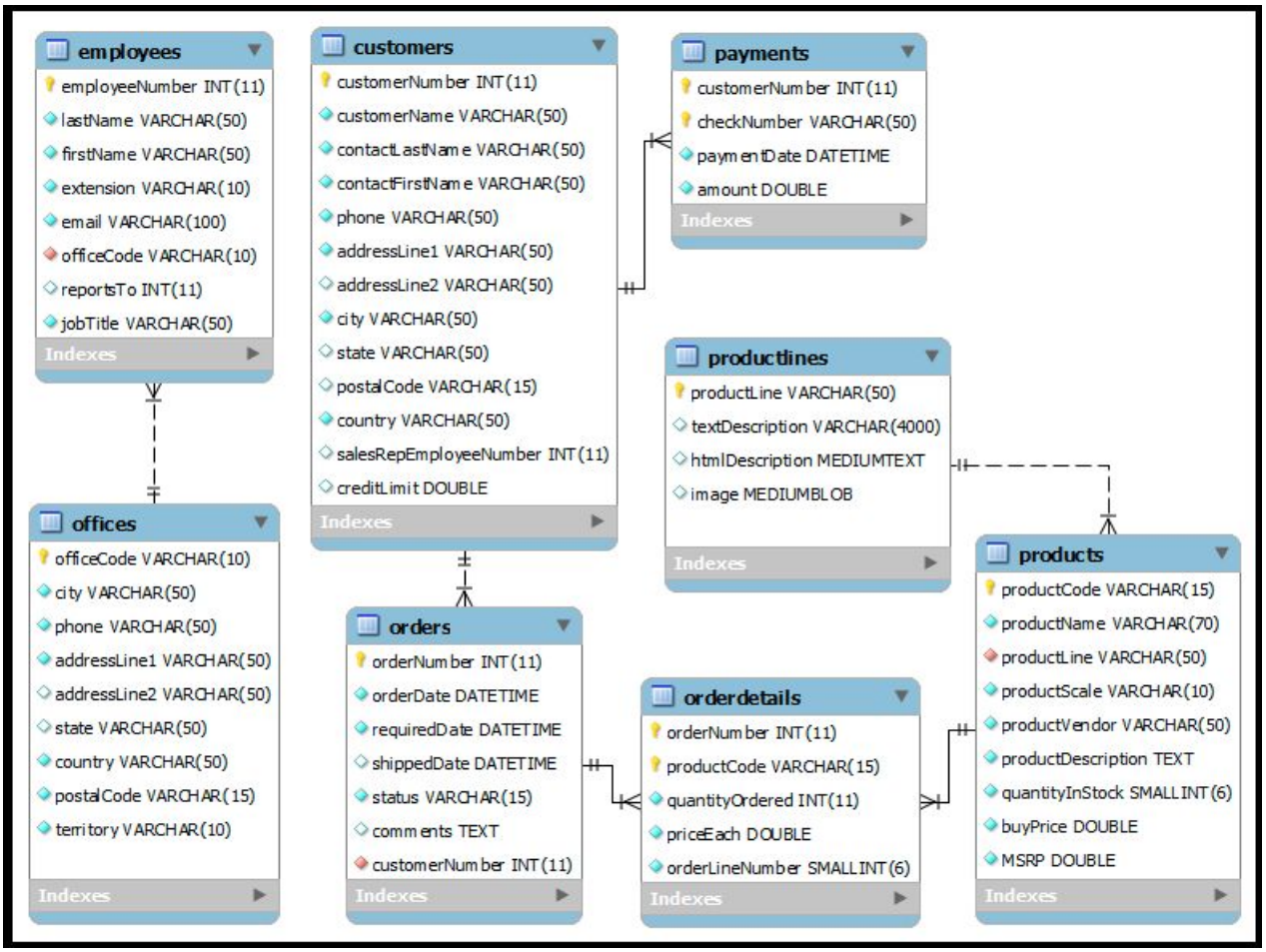
Databases:

Write SQL queries based on the given database schema.

List of Database Tables

1. **Customers**: stores customer's data
2. **Products**: stores a list of scale model cars.
3. **ProductLines**: stores a list of product line category.
4. **Orders**: stores orders placed by customers.
5. **OrderDetails**: stores order line items in each order.
6. **Payments**: stores payments made by customers based on their account.

7. **Employees**: stores all employee information include organizational unit structure such as who reports to whom.
8. **Offices:** stores sale office data.



Queries:

1. Display the details of the employees who are living in “Pitsburg”.
2. Display the details of the customer who paid the highest amount.
3. Display the order number, product name, quantity and total amount for each product for the customer “Diecast Collectables”.
4. Display the details of the products whose quantity in stock is less than 10.
5. Display the customer number, customer name and comments of the orders which were not shipped to the customers.
6. Display the details of the customers who have placed more number of orders.
7. Display the details of the employee who is a sale representative to the customers who ordered “Harley Davidson Ultimate Chopper”.
8. Display the details of the employee who is not reporting to anyone.

Computer Systems

1. Suppose that x and y have byte values **0x66** and **0x39**, respectively. Fill in the following table indicating the byte values of the different C expressions:

Expression	**Value**
x&y	_____
X|y	_____
~x | ~y	_____
x & !y	_____

Expression	**Value**
x && y	_____
x || y	_____
!x || !y	_____
x && ~y	_____

2. Trace and give the output of the following assembly code, Take the n value as 5.

```
Argument: n at %ebp+8
Registers: n in %edx, result in %eax
 1      movl    8(%ebp), %edx
 2      movl    $1, %eax
 3      cmpl    $1, %edx
 4      jle     .L7
 5    .L10:
 6      imull   %edx, %eax
 7      subl    $1, %edx
 8      cmpl    $1, %edx
 9      jg      .L10
10    .L7:
```