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| Department of computer science & Engineering  University of Nebraska—Lincoln |
| Design Document |
| CSCE 156 – Computer Science II Project |
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| [Project to design and implement a simple invoice system to replace the existing system that company currently uses.] |

# Revision History

[This table documents the various major changes to this document]

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| --- | --- | --- | --- |
| Version | Description of Change(s) | Author(s) | Date |
| 1.0 | Initial draft of this design document | Grant Harrison, Sean Mitchell | 2016/9/15 |
| 2.0 | Complete phase 2 | Grant Harrison, Sean Mitchell | 2016/10/7 |
| 3.0 | Phase 3 | Grant Harrison, Sean Mitchell | 2016/11/11 |

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# Introduction

Over the course of the semester we’ll be building a substantial database-backed application in Java. This project is broken up into 4 phases. There will be due dates for each phase and we’ll be working on a specific component on each phase. In these phases we will use data representation & and electronic exchange, create summary detailed reports, database design, and database connectivity and sorted list. Each phase builds upon prior phases and may also require updates and modifications to prior phases. Some services we will be working with include products such as refreshments, parking-passes, season- passes, and movie tickets.

## Purpose of this Document

The design document has many purpose and intended to give experience in technical writing and design. Also it helps the designer to think and plan the initial design prior to implementation so that the development is faster and the designer is able to identify and resolve problems. Design document is used to detail various aspects of the design of the application. This document will be modified and updated constantly through each phase of the project to describe the system functionality.

## Scope of the Project

We have been selected to design and implement a simple invoice system to replace an old system. Cineclark entertainment group is a popular movie theater chain that needs to update their services being managed by the old invoice system. Their old invoice system is based on flat files and is inconvenient to use and maintain. Our responsibility is to design an object oriented system from scratch that is written in java. The system has to support the company’s business model by implementing their business rules and providing the functionality which is the generation of reports managing customers.

## Definitions, Acronyms, Abbreviations

### Definitions

Abbreviations & Acronyms

Edi – Electronic Data interchange

XML – Extensible Markup Language

Json – JavaScript object Notion

OOP – object oriented programming

# Overall Design Description

There are four phases that the project is broken down to. The first phase is Data representation & Electronic Data Interchange. The second is summary and detailed reports. The third phase is the database design and the fourth and final case is database connectivity and sorted list.

## Alternative Design Options

Another design option is would be using procedural programming approach. Although this would be difficult, you would start with a procedure which is a sequence of statements. For example imperative statements such as, assignments, tests, loops and invocations of sub procedures are all examples of procedural programming. However using OOP (Object Oriented Programming) is more useful because it uses abstraction in the form of classes and objects to create models based on real world environment.

# Detailed Component Description

In the first phase we will be designing and implementing objects that will form a basis for the system and create parsers to read data from flat files. In the second phase we will refine the objects and define relationships between them to generate a summary and a detailed report that aggregates pieces of data together. For the third phase we will focus on designing a relational database to model objects and manage data and for the fourth phase we are re-factoring code to load and persist your objects to your database.

For parsing were going to use json or xml. At design time where going to get the description of the file structure and that will generate code for the objects that represents data and parser. The parse will happen at run time and will populate the java classes.

For the design we must use OOP practices and demonstrate the principles abstraction, encapsulation, and polymorphism. Use bottom- up design and identify the entities and design classes that can be used as the building blocks to implement a larger application.

For phase 2 we are adding functionality to the classes we have in Phase 1 and designing new classes to complete the core functionality of the invoice system. We are going to integrate all of our classes to produce two reports. The first report is a summary report that will report overall figures and totals. The second will report the details of each invoice. Goal is to continue to utilize e polymorphic behavior to simplify your code and also stay away from handling similar objects in a dissimilar manner since we have properly defined a common public interface.

## Database Design

Section to be completed in phase 3.

### Component Testing Strategy

Section to be completed in phase 3.

## Class/Entity Model

More specifically were designing classes that are simple data containers. The three data containers are customers.dat, persons.dat, and products.dat. For the persons data file we will create a person class and an address class. Person class has an address class as an attribute so were going to use the address class within the person class. For the customers data file were going to use persons and address class within customers class because it has persons and address class as an attribute. For designing the product class we have looked at movieTicket, SeasonPass, Parkingpass, and Refreshment to see each type have in common. The product has constructors and getters & setters methods involved. For example movie tickets has address attribute so the address class can be used there and season-passes has person class attribute. Parking pass has code and a parking fee. Does not look parking pass contains any of the classes previously written. Refreshments has the format of code name and cost. Persons class is an attribute of refreshments. Some classes we used inheritance which is a hierarchical organization of classes to help and avoid duplication and reduce redundancy. Sub classes inherits all the variables and methods of its immediate parent and its ancestors. For example product has movieTicket, SeansonPass, ParkingPass, and Refreshment as a subclass. Creating these sub classes are as simple as using the word “extends”. For example ParkingPass extends Product

Lastly we need to design converter class. In this class we need a FlatFileReader object to read data from the flat file. This also creates objects and stores the objects in an object array list and returns the array list of objects. We also need to do design a json writer object or xml writer object. This will write the array list into a json or xml file. So the json writer class converts objects that read flat files and writes objects as a string into a file.

For phase 2 were adding functionalities to the classes such as methods for customer and product. For the customer we need to make this class abstract and declare some abstract methods such as get tax, get discount, and get additional fee. We also need to define two types of customers which is general and student. The student type of customer is exempt from taxes, resulting in an 8% discount and a $6.75 processing fee. For the product class we need to declare it abstract as well and defined some abstract methods such as compute subtotal, get tax, and compute grand total. For the new class we are creating, which is an invoice class and an invoice FlatFileReader, to read the invoice data file. The invoice data file is a little more complicated to read. For the invoice data file there is an invoice code, customer code, salesperson code, and invoice date all separated by a semi colon. Invoice data file also has a comma delimited product list. Each product code is either a Movie-Ticket, Parking-Pass, or Refreshment. After the product code there is a single number representing the number of units. With this information about the invoice data file in mind we have an idea of some attributes and methods. Some methods for the invoice class involve methods for computing total cost, taxes and fees, and a method for generating formatted report output.

### Component Testing Strategy

Created many data files such as product, customer, and person file to test program locally once each file reader was able to read each data file correctly. Designed non trivial cases to demonstrate the program was tested locally to some degree and also needed independent input-output. Test cases were meant to probe and break “bad” code, but stay within the requirements specified.

## Database Interface

For the database interface we designed a data model to support our previous application, meaning we implemented an SQL database. We designed tables to support data related to the entities in the previous phase as well as the relationships between this entities.

### Component Testing Strategy

For this component testing strategy we used MySQL to thoroughly test our database design. Our test cases contained several queries to test our design and its functionality. Our goal was to create a design flexible enough that records can be easily added/modified/removed without data integrity problems.

## Design & Integration of Data Structures

For our database design we used many tables like Address, Customer, Email, Invoice, Persons, and Products to accomplish successfully writing our queries. To name a few columns we had for our tables our database, for example we made street, city, and zip for Address table and Persons table included columns like person code, first name, last name, and address id. In every table we created a primary key which is something unique about every table. The naming convention for the primary key we used was usually the table name and the “id” after it. Also in many of the tables there were foreign keys to make relationships between the tables. Some relationships were many to one or many to many relationship. For example some relationships we had were Products and invoice, Invoice to customer, and Customer to Person and Address, which would be a one to many relationship. Because there so many ways to design the database some columns that would be considered “unnecessary or necessary”, however we strived for a design that made sense and was easier to write queries for. Another design option for our database structure would have been to make mapping tables. For example an “Invoice and Products” mapping table would further data integrity and normalization.

### Component Testing Strategy

For this component testing strategy we used MySQL to thoroughly test our database design. Our test cases contained several queries to test our design and its functionality. Our goal was to create a design flexible enough that records can be easily added/modified/removed without data integrity problems.

## Changes & Refactoring

Changed person class and file reader to be able to read 2 emails from a data file. Change code because of non-trivial test cases which were meant to probe and break “bad” code, but stay within the requirements specified. Later on changed database design to have an invoice products table. This made our database structure simpler and allowed us to make queries much simpler.

# Additional Material

[This is an optional section in which you may place other materials that do not necessarily fit within the organization of the other sections.]

# Bibliography

[This section will provide a bibliography of any materials, texts, or other resources that were cited or referenced by the project and/or this document. You *must* consistently use a standard citation style such as APA or MLA (good reference: <http://www.cws.illinois.edu/workshop/writers/citation/)>.]

[1] *Citation Styles*. (n.d.). Retrieved December 19, 2012, from [http://www.cws.illinois.edu/workshop/writers/citation/](http://www.cws.illinois.edu/workshop/writers/citation/))

[2] Eckel, B. (2006). *Thinking in Java* (4th ed.). Prentice Hall.