Customer Order and Machine Data Processing: A Development Prototype for the Magnecomp Thailand

by

Mr. Ajay Dhawan

A Final Report of the Three - Credit Course
CS 6998 System Development Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
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Project Title	Customer Order and Machine Data Processing: A Development Prototype for the Magnecomp Thailand
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Academic Year	July 2000

The Graduate School of Assumption University has approved this final report of the three-credit course, CS 6998 System Development Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Information Systems.

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ABSTRACT

In today's business environment, the Information Technology has created the competitive firms, and services to customers. Information systems have become vital to the management, organization, and operations of the large organizations. They can lead to operational efficiency, doing things better, faster and cheaper. They can result in functional effectiveness, better decision-making and at the same time the work is accomplished within a shorter period of time with more accuracy.

System Analysis and Design Methods are used to analyze, design and develop information systems and computer-based applications for the organization. The Phases of the FAST methodology are conducted step-by-step. These integrates all the popular design strategies, including Structured Design (via Process Modeling), Information Engineering (via data modeling), prototyping (via rapid application development), Joint Application Development (for all methods) and Rapid Application Development.

Therefore, the new Information System is intended to provide better solutions to the existing problems and increase the performance and productivity of operations. This information system will serve the management and end-users of the organization with consistency, accuracy, timeliness, security, and reliability.

ACKNOWLEDGEMENTS

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1.1 Background of the Project

Lack of fast access to information, relational database, inefficient programs and user friendly interface in existing system of Customer data processing and Machine data processing led to the development of a new system. The New System combining both data information of customer and machine under project name 'Customer order and Machine Data Processing Information System'.

The project undertaken by the writer is to develop a new system for managing information of customer, order, machine and product details plus processing of product on GAM. This project is developed for Magnecomp Thailand Ltd., a US based company manufacturing Suspension Assemblies in US, Thailand and China.

During the writer's visit to the company and interview with the staff and in-charge of production Dept: of the company, it is clear that current information system is having problems that need to be rectified and updated according to the new technology.

All the program features of existing System are written in Quick Basic & Machine language, which are outdated and not flexible at all. Moreover they do not support basic user requirement of user friendly Interface. In addition to that the database construct in Microsoft Access version 3.0 lack in data integrity and true relational database. Finally, although their business requires real time fast information they still are using semi-automated system. All of these basic problems led to development of new system under project name Customer order and Machine data processing.

1.2 Objective of the Project

The purpose of this project is to determine weakness of existing system and design new flexible and adaptable system. The objectives of project are as follows:

(1) Study and analysis of the existing system requirements specification and recommend new system requirements.

(2) Analyze the existing business processes and propose new system.

(3) Estimate the cost of the proposed system.

(4) Cost-benefit analysis of the existing and proposed system.

(5) Design database for new system.

(6) Design the new business processes detail.

(7) Design input and output prototypes for new system.

1.3 Scope of the Project

The following types of data are handled in the system:

(1) Customer order data

(2) GA Machine Data

(3) MC Machine Data

Scopes

(1) Centralized database using a standard DBMS on the dedicated server.

(2) The data from IR Machine, Master Grammar will be captured to the DBMS through network.

(3) IR, Gram Audit and Customer order data handling programs will provide

(a) Menu based forms

(b) Flexibility in term of data handling capacity

(c) Graphical user interface to the end users retaining all the existing features of the program in addition to new features as mentioned in requirements.

Gram Audit machine should have the following Queries.

Query Option: The Gram Audit data can be viewed for

(1) A specific Lot No or All Lots

(2) A specific Product or All Products

(3) A specific Date or Range of Dates

(4) A specific GAM or All

(5) A specific MGM or All

Reports:

Daily reports for day-to-day analysis:

(1) Gram Audit IPQC - Gram Load Data Detail.

(2) Outgoing AQL - Gram Load Data Detail.

(3) Order detail.

Monthly Summary report used for management analysis:

(1) Summary Report of IPQC Check.

(2) Summary Repot of Machine part Product.

(3) Summary Report of GMG Machine

(4) Summary Report Customer and order.

Exception Report:

(1) All Customer report.

(2) Individual Customer order report.

(3) Individual Machine Product Report

II. EXISTING SYSTEM

2.1 Background of the Organization

Summary

The MC Precision Group started its operations in 1984 and was principally engaged in the manufacturing of Suspension Assemblies (also known as "Flexures" or "Gimbals") primarily for the use in the production of read-write heads of Hard Disk Drives or HDDs used in computers. The group's first manufacturing plant was located in California, USA. The suspension Assembly is an extremely high precision product, which holds the read-write heads in position above the magnetically coated disks in the HDDs as well as the removable disk drives.

Location and Facilities

As the business expanded, MC Precision Ltd. defined its corporate strategy to establish itself as a low-cost producer and focus on technological innovation, high quality and customer service. In line with its strategy and growth of the computer and HDD industry in the late 1980s, the group began its expansion and regionalisation efforts by setting up manufacturing facilities in Asia where it had the benefits of significantly cheap labour and lower operational costs than in the USA. The purpose of locating these manufacturing locations in Asia was also to be situated close to its Customers to facilitate timely delivery of Suspension Assemblies and assures quick responses to customers' demands. Therefore they started Magnecomp Thailand LTD. in Bangkok in year 1992.

Business

The Group is engaged in the production of suspension assemblies, a critical component of the read-write heads of the Hard Disk Drives. The heads do not touch the surface of the spinning disk but instead "fly" at a precise microscopic height above the disk because of the equilibrium of the upward force of the air driven under the head and the downward force applied by the suspension assembly.

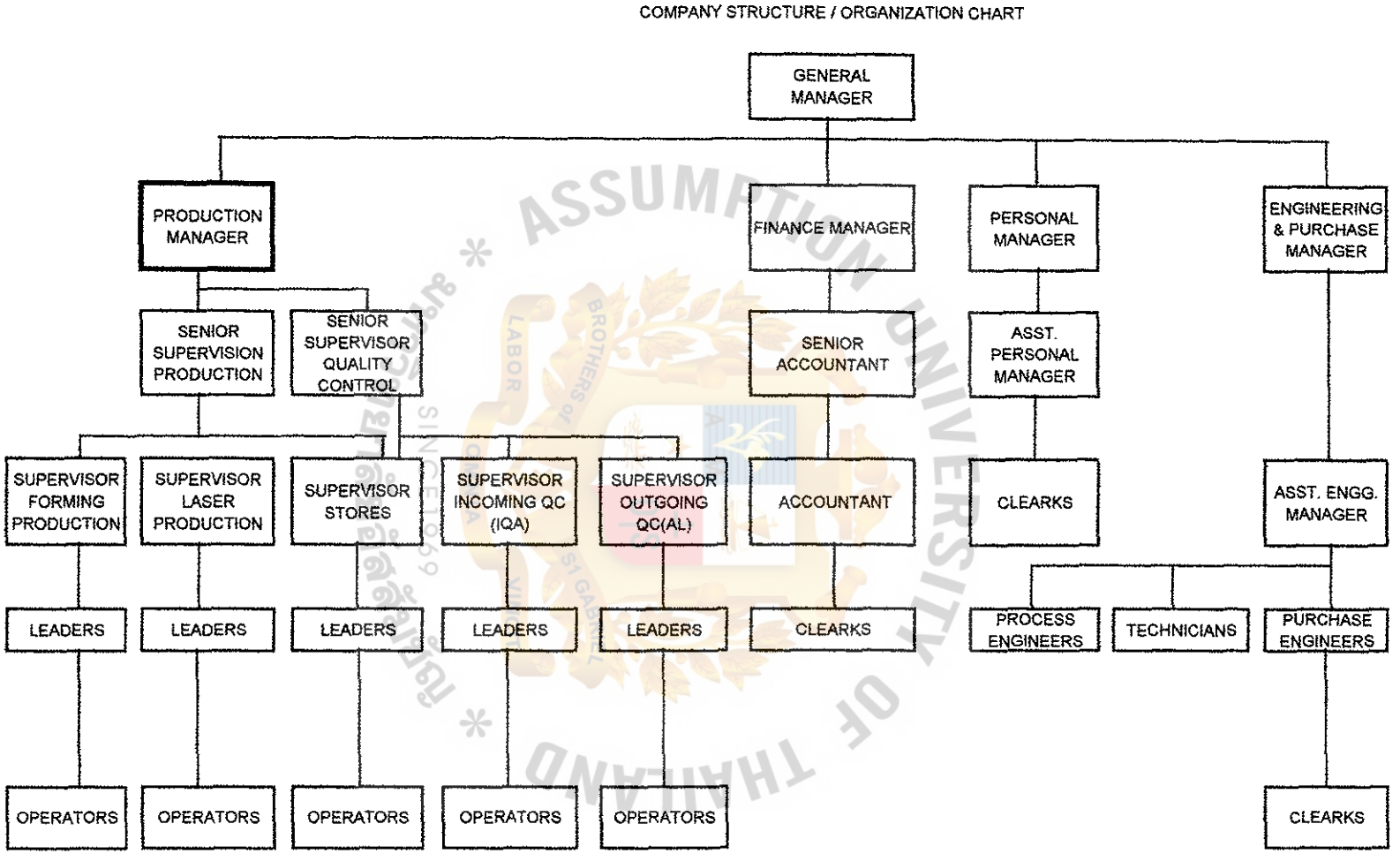

Figure 2.1. Magnecomp (Thailand)Ltd.

2.2 Existing Customer Order and Machine Data Processing System

Two types of information handle the existing data processing system.

(1) Customer order data processing

(2) Machine data processing

Customer Order Data Processing Features

(1) Maintains Customer Detail - Maintains and store information about Customers like customer name, code, and addresses and credits details.

(2) Maintains Order Detail - Maintain and store information of Customer orders like issue and delivery date, quantity and price.

Machine Data Processing Features – There are two types of machine audit machine (MG Machine) and production machine (GA Machine).

(a) GA-Production Machine Features

(b) Correlation feature – This feature allows the comparison of the current samples reading with standard sample reading. It is done both manually and automatically.

(c) Auto correlation – calculate factor based on difference in the standard sample mean reading and the actual sample mean reading of the 10 pieces on the machine and sample is checked a total of three times and store standard sample data in the Text files.

Manually feed correlation – calculate.

Mean of every sample check.

Standard deviation

Range

Max

Min

Total no. Of parts.

(d) Correlation repeatability Feature – Read actual sample data from the machine three times and calculate range, individual part mean and mean reading of every sample and then compare each actual sample with standard sample separately to calculate correlation and status.

(e) IPQC gram check – This feature use to check performance of the machine by checking the gram reading adjusted by the machine and display on the screen the data of latest 150 parts checked.

(2) MG-Master Audit Machine Features.

(a) Sample Generation - Generate sample No: Automatically or Assigned Manually on the bases Product ID and Machine Name then allocate sample no: to the GA-Machine and store that in sample file. One sample cannot be allocated to more than five products.

(b) Outgoing AQL - Actual Quality Level outgoing data created in separate database file in which on line information of gram value is stored on the base of product ID and lot Number. Apart from data input automatically from the machine, they some times use simulation data mode which allow them to put gram value manually from keyboard and calculate Mean, Range, SD, CPK base on no: of gram value input. The sum of total number of data input will be calculated automatically in the report.

(c) Audit IPQC - Input to audit gram for quality check manually or Automatic then calculate the mean, standard deviation, Max. & Min. value CPK based on gram value and compare with target CPK set in part master and result pass or fail.

Database - The present database maintained on file server and based on index sequential file structure.

All information is store in database using MG Machine.

Two kinds of information is store in the database.

(1) Production Information

(2) Machine Information

Production Information

(1) Information about the product like product number, name and type.

(2) Information about the part of product like parts name, max, min value, target mean, standard deviation, and correlation.

(3) Information like audit part machine name, gram value, SC-operator etc.

Machine Information

(1) GA-Production Machine – GA machine number, type and name.

2.1 Current Problem and Area of Improvement

Current Problems

The Problem Definition of existing system –

In the existing system there is a performance, Data control, Inflexibility and Efficiency problem. The system is not flexible enough to adapt to new changes fast and full and because of that efficiency and performance suffers. In addition to that information is delayed and inadequate.

Table 2.1. Problem Statement.

Problem Or Opportunity	Urgency	Visibility	Priority	Proposed system
1. Delay Information – Information required is delayed and not adequate because of lack of data Integrity.	ASAP (As soon as Possible)	Very High	1	1.Quick Fix 2.Later Develop New System
2. Data Control – In the existing system database is distributed and not a true relational database which causes delay in information.	3 month	High	2	Develop New Database
3. Economic Problem – Existing System is too complicate to understand cost and benefits.	3 Month	High	2	Cost and benefit analysis of new and old system.
4. Performance Problem –The existing system is not able to handle present workload, which has increased considerably in last few years to affect the performance. Moreover all programs are written in Q-basic, which are outdated and time consuming.	6 month	High	3	Develop New System

Table 2.1. Problem Statement (Continued).

Problem Or Opportunity	Urgency	Visibility	Priority	Proposed system
5. Inflexibility – The current information system is not flexible to support new and exceptional situations.	6 month	High	3	Develop New System
6. Efficiency Problem – • Under-utilization of existing resources. • Redundancy of data. • Distributed database doesn't suit the processing of existing system.	9 Month	High	3	Develop 1.Relational database 2.Centerlised distributed system.

III. PROPOSED SYSTEM

3.1 User Requirements

All the data will be kept on the Centralized server with MSSQL Server Database and can be shared through different workstations (connected to IR Machines as well as not connected to IR machines).

All the existing features of Customer and Machine Data process, IR Machine and Audit Machine Will be rewritten in users friendly language (4GL) with Input and Output inter face. Such as:

(1) Customer record.

(2) Maintain Order record.

(3) Maintain Machine record.

(4) Maintain Product record.

(5) Sample Generation Automatic and Manual.

(6) Correlation & Repeatability test.

(7) IPCQ Check.

(8) AQL Manual Simulation

Menu based forms.

(1) Flexibility in terms of data handling capacity.

(2) Graphical user interface to the end user.

(3) All existing Audit Machines to be networked to the dedicated server. It should be possible to access and manipulate the stored data.

Input Screens

(1) Customer Master

(2) Order Detail Master

(3) Product ordered Master

(4) Machine Master

(5) Product Master

(6) Part Master

(7) Production Master

(8) IPQC Audit Transaction

(9) Outgoing AQL Transaction

(10) Sample Generation Transaction

(11) Calculation Transaction.

Output Screens

Reports:

Daily reports for day-to-day analysis:

(1) Gram Audit IPQC - Gram Load Data Detail.

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(3) Order Detail.

Monthly Summary report use for management analysis:

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Exception Report:

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Query Option: The Gram Audit data can be viewed for

(1) A specific Lot No: or All Lots

(2) A specific Product or All Products

(3) A specific Date or Range of Dates

(4) A specific GAM or All

(5) A specific MGM or All

Processes

(1) Maintain Customer Record.

(2) Maintain Order Record.

(3) Maintain Machine Record.

(4) Maintain Product Record.

(5) Sample Generation Automatic and Manual.

(6) Correlation & Repeatability Test.

(7) IPQC Check.

(8) AQL Manual Simulation.

3.1.1 New Objectives after User Requirements

(1) The centralized database will be maintained on the server consisting of Machine data, Audit data detail, and Customer and order details.

(2) Reduce redundant data.

(3) Reduce the unnecessary paperwork by as much as 80%

(4) Increase the throughput of system up to optimum.

(5) Automate business processes as much as 80% to streamline the business.

(6) Support Information requirement of the user such as detail, summary report and predetermine queries.

(7) User-friendly Interface.

3.2 System Design

3.2.1 Database Design

A database is a collection of interrelated files, having the ability to share the same data across multiple applications and systems.

A relational database design has been used in this project, which provides listed features and follows the Integrity rules given below:

Listed Features Data must be simple and easy to use.

(1) Data must be independent.

(2) Data must be flexible, scalable, and adaptable for future requirements and application.

(3) Data must be reliable.

(4) Data must provide for efficient storage, update, and retrieval.

(5) Integrity Rules

(6) Key Integrity: Primary key must not contain null value.

(7) Domain Integrity: Appropriate controls must be designed to ensure that no field takes on the value that is outside the range of legal values.

(8) Referential Integrity: A foreign key, which is a Primary key in any other table must match that Primary key or be null. The foreign key implements the relationship between records in the tables. Their use increases the flexibility and scalability of any database.

3.2.2 Software Design

This system has been developed using the popular design strategy that is the modular design. This technique deals with the size and complexity of the program by breaking into the small sub programs.

A module is a group of executable instructions with a single point of entry and a single point of exit, which, results in a computer program that is easy to implement and maintain.

The system is based on the top-down approach. As the system progresses, it is decomposed into its subsystem. It provides an orderly and systematic framework for the system.

3.2.3 Input Design

Input design is very important for any system success. It must be made in a simple and easy to use format. Following things must be considered while designing the input:

The volume of input data should be minimized.

(1) Input is only variable data captured.

(2) Derived attribute is never captured as input.

(3) User friendliness must be considered.

(4) Users must be involved.

All of these factors are taken into consideration while designing the inputs with help of a software tool Visual Basic 5.0.

3.2.4 Output Design

Output can be considered as the proof of the correct and successful system. This is the visible component of the working information system. Output design should also be made simple and easy to understand. Users are actively involved in the output design as well.

(1) Following things were taken into consideration while designing the outputs of Customer Order and Machine data Processing project.

(2) Every report must have a title.

(3) Report and screens should include section headings to segment the large amount of information.

(4) Legends are used where necessary to formally define the fields on the reports and screens.

3.3 Hardware and Software Requirement

3.3.1 Hardware Requirement

(1) Server

(a) Windows NT Backup Server

(b) Processor Pentium III 550 MHz

ECC RAM 256 MB.SDRAM

(c) Cache Memory 512 KB Second level ECC cache

(d) Hard Disk 20 + GB

(e) Floppy disk 1.44 MB

(f) Backup Driver Terabyte Tape

(2) Client -

(a) Existing one but with minimum of 32 MB RAM

(b) No hard disk

(c) Port serial 2 ports

(d) Port parallel 1 port

(e) Operating System MS Window 98

(3) Net working Topology as specified by project team after study networking environment.

(4) I/O Cards required for capturing the data on RS 232 Port.

3.3.2 Software Requirements

(1) Software – Window NT 4X

(2) Database – MS SQL Server 7.0

(3) Application Development tool – Visual basic 5.0

Existing System Configuration

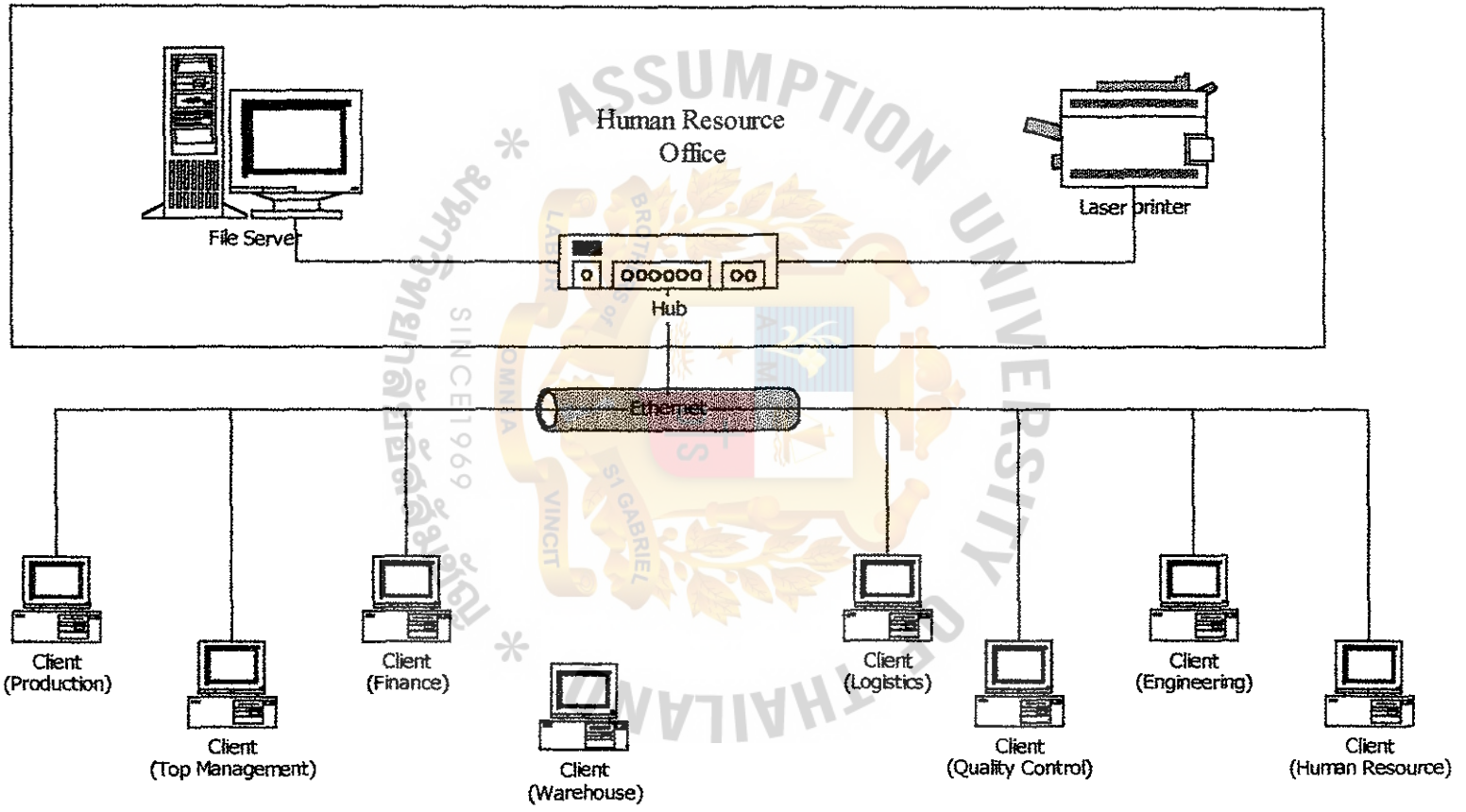


Figure 3.1. Existing Network.

3.4 Candidate Matrix and Feasibility Analysis

Table 3.1. Partially Completed Candidate Matrix.

Characteristic	Candidate1 (Existing System)	Candidate2 (Package)	Candidate3 (Customized)
Portion of system computerized.	Microsoft MS Access 95 based Database and Program written in Q-basic to handle customer record and machine data processing.	Windward system software package solutions, Includes Machine control, invoicing, customer billing, Accounts payable and receivable, purchase order. But does not include all requirements of the user.	Develop own software solution, Includes Machine data control, customer purchase order and billing, customer Account payable and receivable.
Benefits	Easy to customized, save cost and time of system development.	Quick to install, easy to customized and more flexible, save cost and time	Fully support user required business processes.
Servers and workstation	Technical architecture Need to update Pentium pro, MS windows NT Class servers and NT 4.0 workstation. (Client)	Technical architecture Pentium pro, MS windows NT Class servers and NT 4.0 workstation. (Client)	Technical architecture Pentium pro, MS windows NT Class servers and NT 4.0 workstation.
Software tool needed	MS Access 97 for customization of package.	MS visual basic 5.0 and MS Access 97 for customization of package.	MS visual basic 5.0
Application package	Package solution	Package solution	Custom solution
Method of data processing	Centralized Computing	Client/Server	Client/Server
Output Devices	(2) HP4MV department laser printer. (2) HP5SL LAN laser printer	(2) HP4MV department laser printer. (2) HP5SL LAN laser printer (1) PRINTRONIX bar code printer	(2) HP4MV department laser printer. (2) HP5SL LAN laser printer (1) PRINTRONIX bar code printer

Table 3.1. Partially Completed Candidate Matrix (Continued).

Characteristic	Candidate1 (Existing System)	Candidate2 (Package)	Candidate3 (Customized)
Input Devices	Key board and mouse	(12) CCD bar code scanner Apple "quick take" camera	(12) CCD bar code scanner Apple " take" camera
Storage device and implication	MS SQL DBMS server	MS SQL DBMS server With 100GB capacity	MS SQL DBMS server With 100GB capacity

Table 3.2. Feasibility Analysis.

Feasibility Criteria	(%)	Candidate (Existing)	Candidate 2	Candidate 3
Operational Feasibility Functionality Feasibility - What degree the organization will be benefited by the candidate. Political feasibility How well the solution will be received from both management and user prospective.	30%	Only supports requirements of Customer and Machine data processing and would be modified to take advantage of software functionality. Score: 65	Mostly support user and management required functionality. Require a few modifications. Score: 90	Fully support user and management required functionality . Not required any modification in the present scenario. Score: 100
Technical Feasibility Technology - Mature, availability, desirability technology. Expertise – Technical expert needs to develop, operate and maintain the candidate solution.	30%	VICS is a mature technology product required either to hire or train c++ Expertise to perform modification. Score: 60	Windward system is mature technology product and easily available. Required either hire or train c++ Expertise to perform modification. Score: 60	Although current technical staff is using Fox-pro. It is easier to train existing staff VB at cheaper cost. Score: 90
Economic Feasibility Cost of develop Payback Period: Net Present value cost:	30%			
Schedule Feasibility How the solution will take to design to implement	10%	Less than 4 month Score: 95	Less than 4 month. Score: 95	9-12 month Score: 85
Ranking	100	70	83.77	90

3.5 System Cost Evaluation and Comparison

3.5.1 System Cost

Costs are divided into two categories.

(1) Development Costs, which are associated with the development of the system. System development costs are usually one-time costs that will not recur after the project has been completed.

(2) Operational costs, which are associated with operating a system. On the other hand operating costs tend to recur throughout the lifetime of the system. Operational cost can be Fixed as well as Variable cost.

Fixed costs occur at regular intervals but at relatively fixed rates, e.g. lease payments and software license payments.

Variable costs occur in proportion to some usage factor, for instance: cost of computer usage, which vary with the workload.

Table 3.3. Cost Comparison between Computerized System and Manual System, baht.

Cost Items	Years					
	0	1	2	3	4	5
Manual System						
1.Hardware Cost:	100,000	20,000	20,000	20,000	20,000	20,000
2. Software Cost:	60,000	12,000	12,000	12,000	12,000	12,000
3. Maintenance Cost:	10,000	10,000	11,500	13,225	15,209	17,490
4. Personnel Cost:	600,000	600,000	690,000	793,500	912,525	1,049,404
5. Stationary Cost:	60,000	60,000	69,000	79,350	91,253	104,940
6. Office Equipment Cost	10,000	10,000	10,000	10,000	10,000	10,000
7. Utitlity Cost:	60,000	60,000	69,000	79,350	91,253	104,940
Total Cost:	900,000	772,000	881,500	1,007,425	1,152,239	1,318,775
Cumulative Cost:		772,000	1,653,500	2,660,925	3,813,164	5,131,938
Computerized System						
1. Development Cost:	180,600	180,600				
2. Hardware Cost:	549,500	109,900	109,900	109,900	109,900	109,900
3. Software Cost:	229,000	45,800	45,800	45,800	45,800	45,800
4. Personnel Cost:	350,000	350,000	385,000	423,500	465,850	512,435
5. Maintenance Cost:	81,500	81,500	89,650	98,615	108,477	119,324
6. Stationary Cost:	70,000	70,000	73,500	77,175	81,034	85,085
7. Office Equipment Cost	14,000	14,000	14,000	14,000	14,000	14,000
8. Utitlity Cost:	80,000	80,000	84,000	88,200	92,610	97,241
Total Cost:	1,554,600	931,800	801,850	857,190	917,670	983,785
Cumulative Cost:		931,800	1,733,650	2,590,840	3,508,510	4,492,295

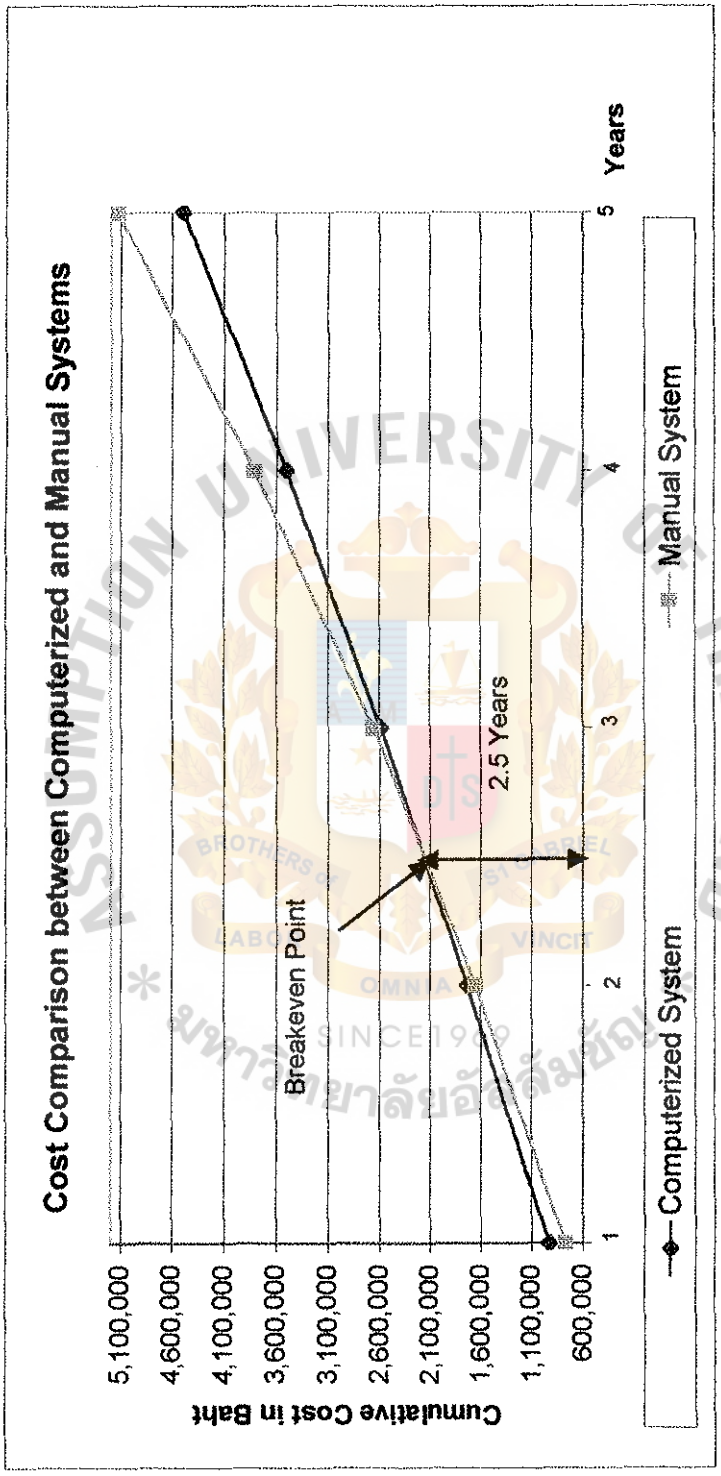


Figure 3.4. Cost Comparison between Computerized System and Manual System.

3.5.2 System Benefits

Benefits are categorised into Tangible and Intangible benefits. Tangible benefits are those that can be easily quantified. These are usually measured in terms of monthly or annual savings or profit to the firm. Intangible benefits are those benefits that are believed to be difficult or impossible to quantify. If a benefit cannot be quantified, it is difficult to accept the validity of the cost-benefit analysis that is based on incomplete data.

Estimated benefits: (per annum) for Five year see Tables 3.5 and 3.6.

Table 3.4. Proposed System Benefit, Baht.

Cost Items	Years				
	1	2	3	4	5
Increase in Customer	200,000.00	300,000.00	400,000.00	500,000.00	600,000.00
Cost Reduction due to reduce in redundancy	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00
Reduction of transaction costs	100,000.00	200,000.00	300,000.00	400,000.00	500,000.00
Cost reduction of paper	75,000.00	75,000.00	75,000.00	75,000.00	75,000.00
Improved Company Goodwill	-	-	-	-	-
Tangible Benefits	525,000.00	725,000.00	925,000.00	1,125,000.00	1,325,000.00
Better Decision Making	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
Effective time and resource management	90,000.00	110,000.00	130,000.00	150,000.00	170,000.00
Intra-organization cooperation	100,000.00	150,000.00	200,000.00	250,000.00	300,000.00
Intangible Benefits	315,000.00	400,000.00	485,000.00	570,000.00	655,000.00

Table 3.5. Payback Analysis, Baht.

Cost Items	Years					
	0	1	2	3	4	5
Development Cost:	919,100.00					
Operation and Maintenance cost:		417,500.00	438,375.00	460,293.00	483,307.00	507,472.35
Discount Factor for 12%:	1.00	0.89	0.80	0.71	0.64	0.57
Present Value of annual cost:	919,100.00	372,827.00	349,384.00	327,728.00	307,383.00	287,736.82
Cumulative time-adjusted cost over life-time:	919,100.00	1,291,927.00	1,641,311.00	1,969,039.00	2,276,422.00	2,564,158.82
Benefits derived from operation of the New System:	0	850,000.00	935,000.00	1,028,000.00	1,131,350.00	1,244,485.00
Discount factor for 12%:	1.00	0.893	0.797	0.712	0.636	0.567
Time adjusted benefits:	0	759,050.00	745,195.00	731,936.00	719,539.00	705,623.00
Cumulative time-adjusted benefits over life-time:	0	759,050.00	1,504,245.00	2,236,181.00	2,955,720.00	3,661,343.00
Cumulative lifetime adjustment cost+benefits:	-919,100.00	-532,877.00	-137,066.00	267,142.00	679,298.00	1,097,184.00

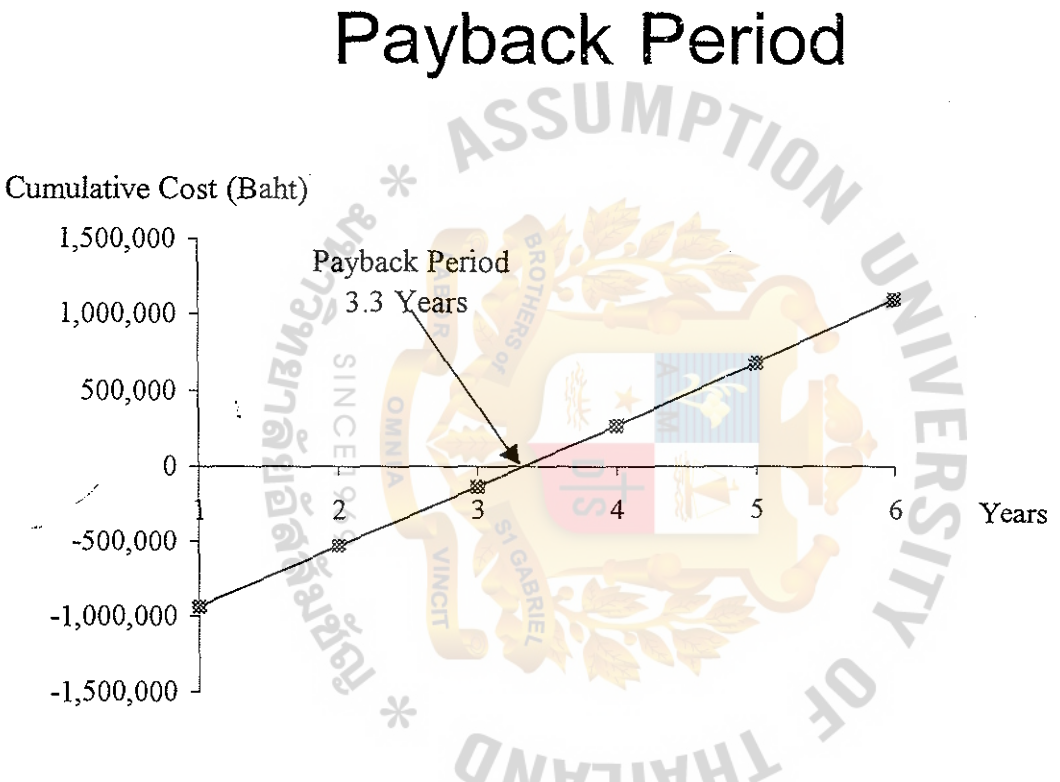


Figure 3.5. Payback Analysis.

IV. PROJECT IMPLEMENTATION

4.1 Project Management

A project is considered as a sequence of unique, complex, and connected activities having one goal or purpose that must be completed by a specific time, within the budget and according to specification. Hence for any system development project, effective project management is necessary to ensure that the project meets the deadline, is developed within an acceptable budget, and fulfills expectations and specifications.

For this reason, the project management techniques and project modeling techniques are very helpful in implementing the project successfully. A Gantt chart is being used here to effectively present the milestones of this project. It also presents the definition, direction, monitoring, and controlling the development of this information system with a specified time frame.

Note: Figure 4.1

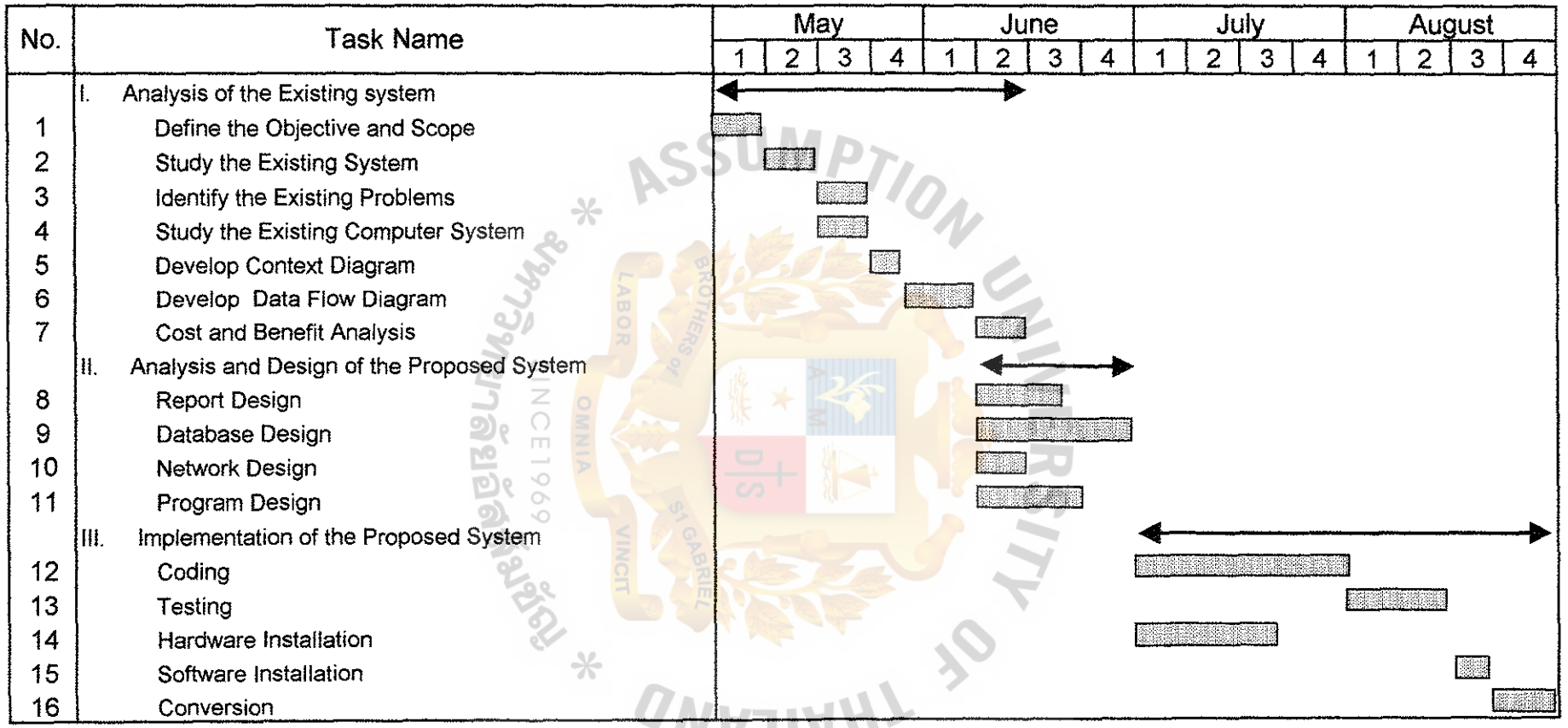


Figure 4.1. Project Plan of Computer Information System.

4.2 Overview of System Implementation

System implementation is the construction of the system and the delivery of that system into production.

System implementation consists of two phases, namely: Construction and Delivery.

The purpose of the construction phase is twofold:

(1) To build and test a functional system that fulfils business and design requirements.

(2) To implement the interfaces between the new system and existing production systems.

After the approval of the technical design statement and prototypes, the construction of the new system begins. During the construction, we construct and test the system components. First activity in the construction phase is to Build and test the networks. The second activity is to Build and test the databases. This task must immediately precede other programming activities because databases are the resources shared by the computer programs to be written. After completion of this activity, the installation and testing of the Software package will follow writing and testing of the new programs.

4.2.1 Testing

Testing is a very important skill in computer programming. Modules and programs are tested and debugged as they are written. Testing should not be deferred until after the entire program has been written.

Following types of testing are performed:

Stub testing: A test performed on individual modules, whether they be main program, subroutine, subprogram, block, or paragraph.

Unit or Program testing: A test whereby all the modules that have been coded and stub tested is tested as an integrated unit. Unit testing uses the test data created during the design phase. All modules are then implemented and that unit equals the program itself.

System testing: A test that ensures that application programs written in isolation work properly when they are integrated into the new system.

Peak load testing: A test that determines whether the system can handle the volume activities in the peak period of processing demand.

Storage testing: A test that determines the storage capacity of the system to store transaction data on a disk or in other files.

Backup and recovery testing: It tests that all backup and recovery procedures are working properly and with consistency.

Performance or Response time testing: A test that determines how long will be taken by the system to process one instruction.

Human factors testing: It determines how users will react when they use the system, such as input, output, and interface design.

4.2.2 Prepare Conversion Plan

The purpose of this activity is to prepare a detailed conversion plan to provide a smooth transition from the old system to the new system. Following steps are required to complete this activity:

Collect and review design specifications for the new system to identify databases to be installed and user training needs.

(1) Establish a schedule for installation of databases.

(2) Identify a training program and schedule for the system users.

(3) Develop a detailed installation strategy to follow for converting from the existing to the new production information system.

(4) The development team agreed upon the Parallel conversion approach for the conversion. Under this approach, both the old and the new systems are operated for some period of time. This is done to ensure that all major problems in the new system have been solved before the old system is discarded. This strategy minimizes the risk of major flaws in the new system causing irreparable harm to the business.

4.2.3 Training

Converting to a new system necessitates that system users be trained and provided with documentation that guides them through using the new system.

Training is performed on the group basis because it is a better use of time and it encourages group learning possibilities. The golden rule applies here in user manual writing: "Write unto others as you would have them write unto you". Simple and clear user manuals are given to the users. The user manuals contain a detailed explanation of people's jobs for the new system. It also shows how the new system fits into the overall workflow. Training needs of the system users is reviewed by referring to the conversion plan. Schedule training sessions are then established and conducted on the group basis.

4.2.4 System Support

System support is the ongoing maintenance of a system after it has been placed into operation. This includes program maintenance and system improvements. It consists of four ongoing activities, namely:

(1) System maintenance

(2) System recovery

(3) End-user assistance

(4) Systems enhancement and reengineering

System maintenance is actually the corrective action taken when some errors or bugs are identified in the system. These bugs may be caused by the miscommunication of the requirements or the design flaws. Some are even caused by the unanticipated situations, which were therefore not tested.

The fundamental objectives of the system maintenance are:

(1) To make predictable changes to existing programs to correct errors those were made during systems design and implementation.

(2) To preserve those aspects of the programs that were already correct.

(3) System recovery can be defined as the overcoming from crash. From time to time, system failure is inevitable. It generally results in an aborted or "hung" program and possible loss of data. Hence during system recovery, we fix the system.

(4) System support also asks for the End-user assistance. Users always require additional assistance, no matter how well they have been trained. Hence, we should routinely observe the use of the system, conducting user satisfaction surveys and meetings, changing business procedures and clarifications, and providing additional training, logging additional ideas and requests in the repository.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Magnecomp Thailand Co., Ltd., a manufacturer of suspension assemblies for using in the hard disk drive industries, is in its developing stages. As the demand for forecast of the hard disk drives is continuously growing, this company is expected to grow with it. The integration of different software technologies exist in the company under one software technology and it is one of the many plans undertook by the company to face new changes and demands because of development of the company.

The development of the Customer order and Machine data Processing system is also a step towards it. Before that customer order is processed separately from machine data processing, which causes redundancy data problem and further leads to data inconsistency and is also not cost effective because of its utilizing more resources and giving poor results. This system will provide the production department to enter customer details, order details and order processing at the same place with the automatic generation of all the customers, orders, machine and processing reports along with queries and exception reports.

The Advantage of the new system is optimum utilization of resources, effective data processing. This will gain better all benefits to the company as mentioned in the cost and benefit analysis and these benefits will be realized after the third year of the placement of this system. The cost-benefit analysis of the system also shows the same result.

See Table 5.1 Degree of Achievements on next page.

Table 5.1. The Degree of Achievement of the Proposed System.

Process	Existing System	Proposed System
Application Process	1.5 hrs	1 hr.
Inquiry Process	15 mins.	5 mins.
Modification Process	20 mins.	10 mins.
Report Prepare Process	15 mins.	5 mins.
Printing Process	5 mins.	5 mins.
Total	2 hrs. 25 mins.	1 hrs. 25 mins.

5.2 Recommendations

The Company's main motto is to reduce the cost and achieve maximum benefits from their information system during its developing stage. The new Customer order Machine data processing system is essential for the strategic mission and plan of Magnecomp Thailand Ltd., unless old legacy system was dramatically improved.

It is recommended that the company should reduce cost and increase efficiency by taking three important steps.

(1) Company should construct new centralized database for customers and machine data with new and updated technology.

(2) To reduce the processing cost, review the existing processes with new technology.

(3) Develop new system, which are more user friendly.

The company can also utilize the benefits of the Internet to reach to their customers and suppliers making an enterprise network.

In the end, the writer would like to recommend that the new and upcoming technologies should be utilized for better efficiency and performance in the company.

APPENDIX A

CONTEXT DIAGRAM

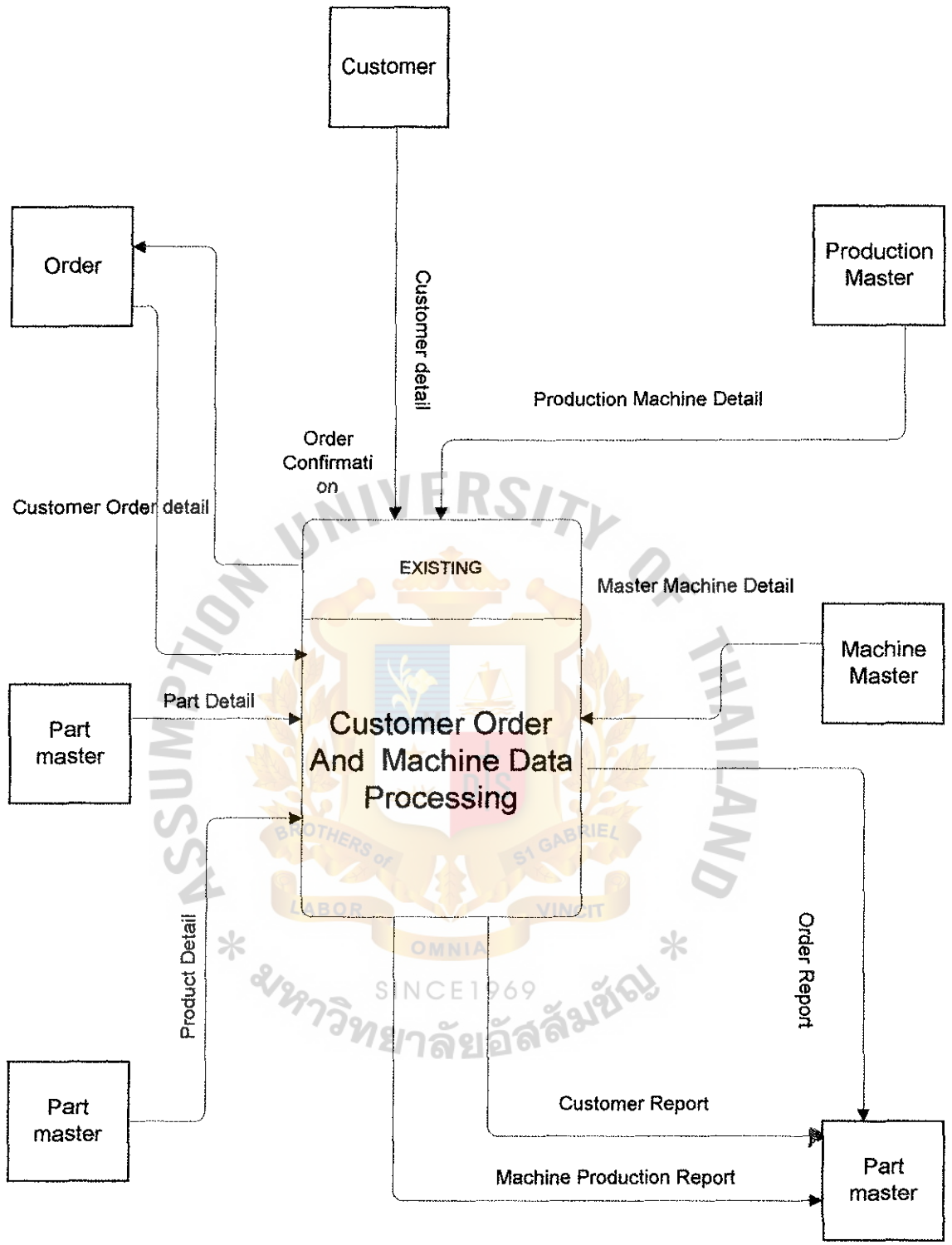


Figure A.1. Context Diagram of the Existing System.

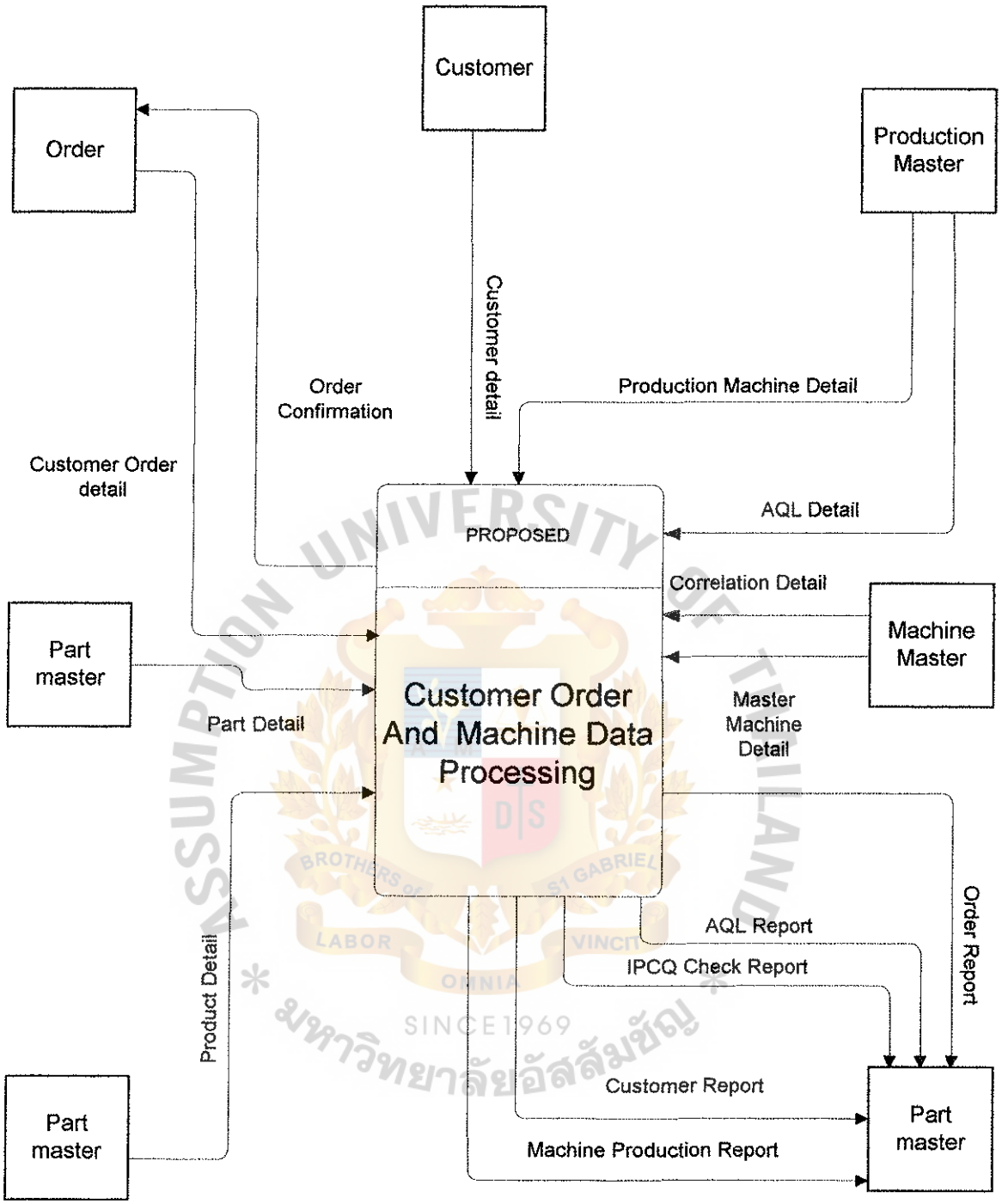


Figure A.2. Context Diagram of the Proposed System.

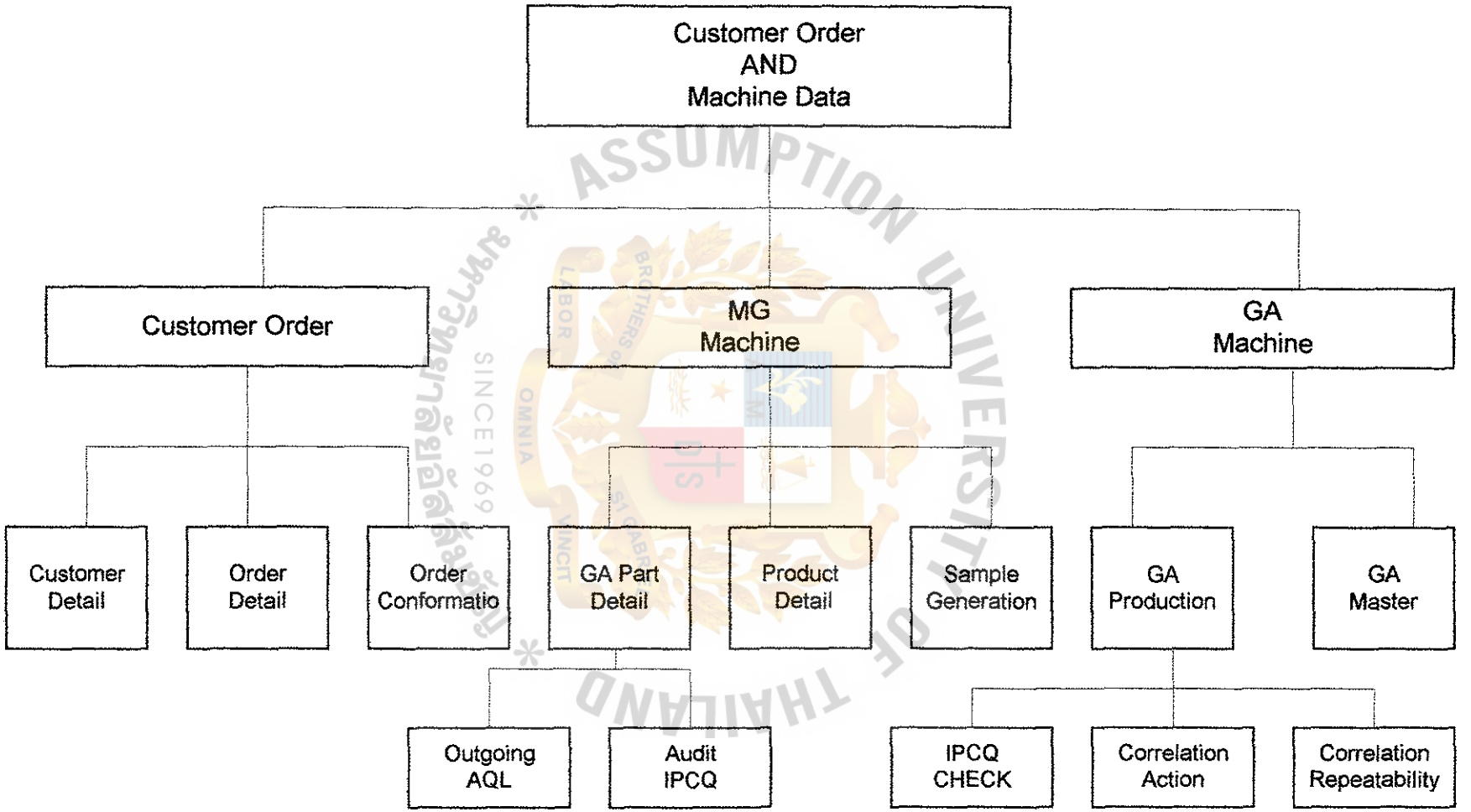


Figure B.1. Event Decomposition Diagram.

APPENDIX C

PROCESS DIAGRAM

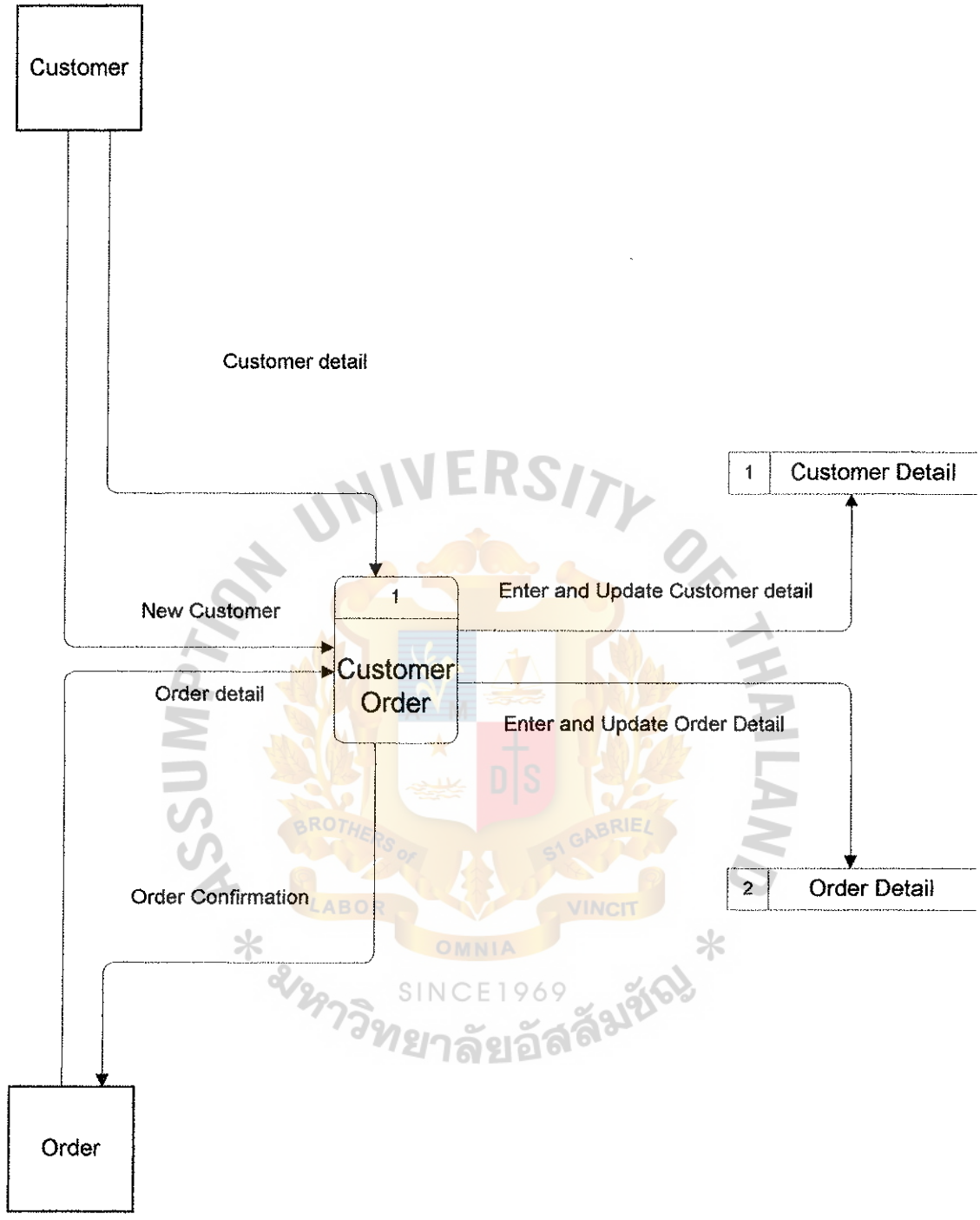


Figure C.1. Customer Order Event Diagram.

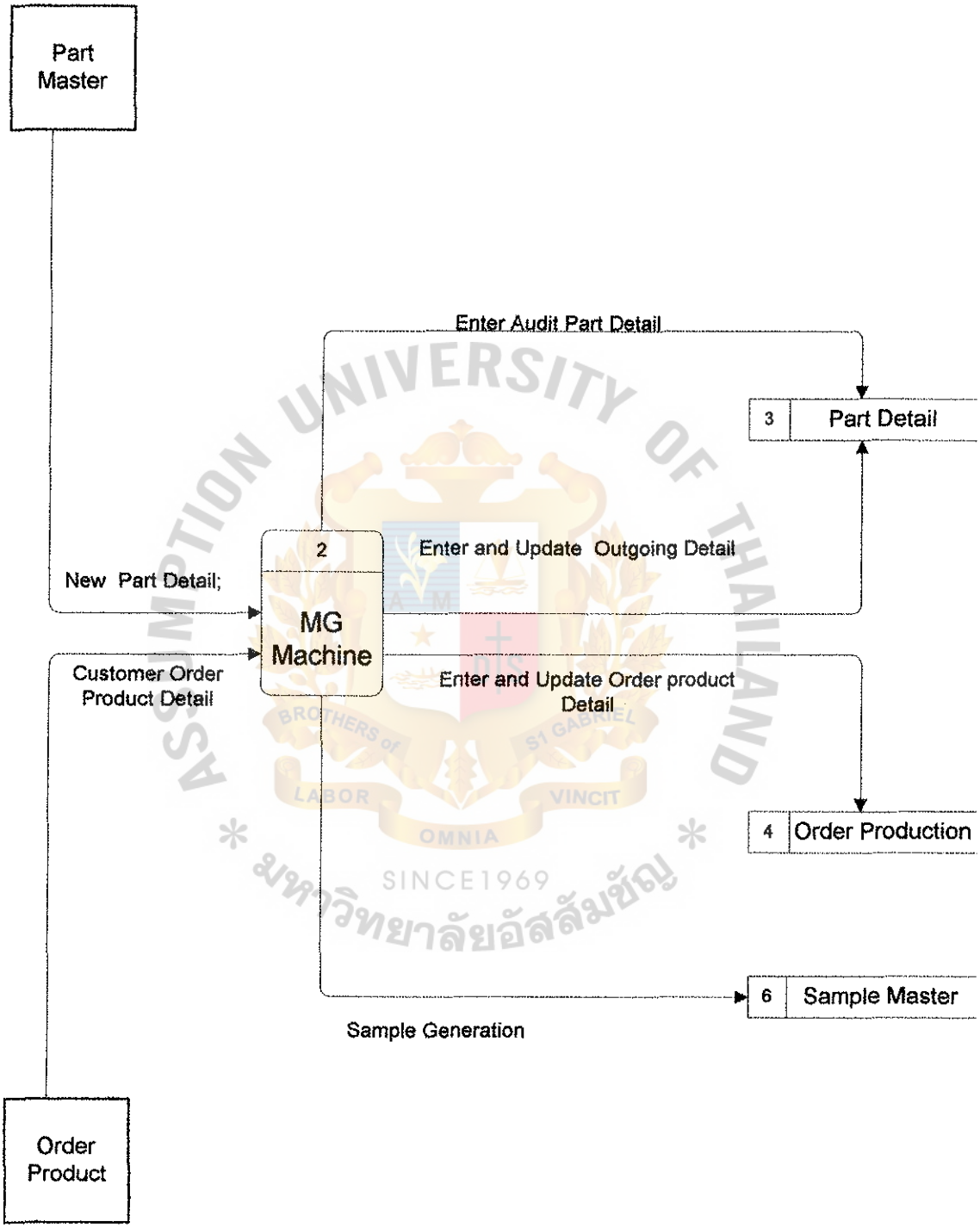


Figure C.2. MG Machine Event Diagram.

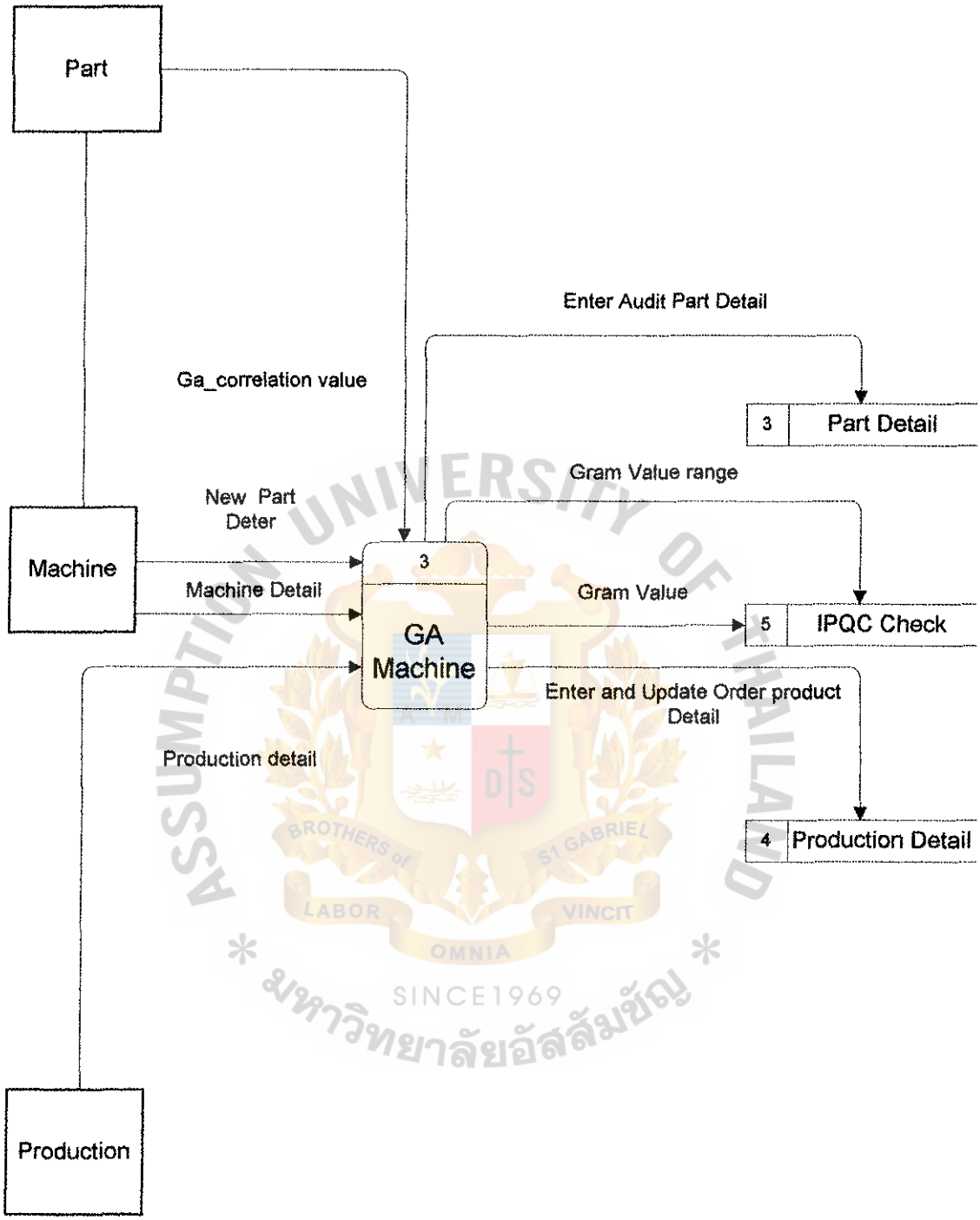


Figure C.3. GA Machine Event Diagram.

APPENDIX D

DATA FLOW DIAGRAM

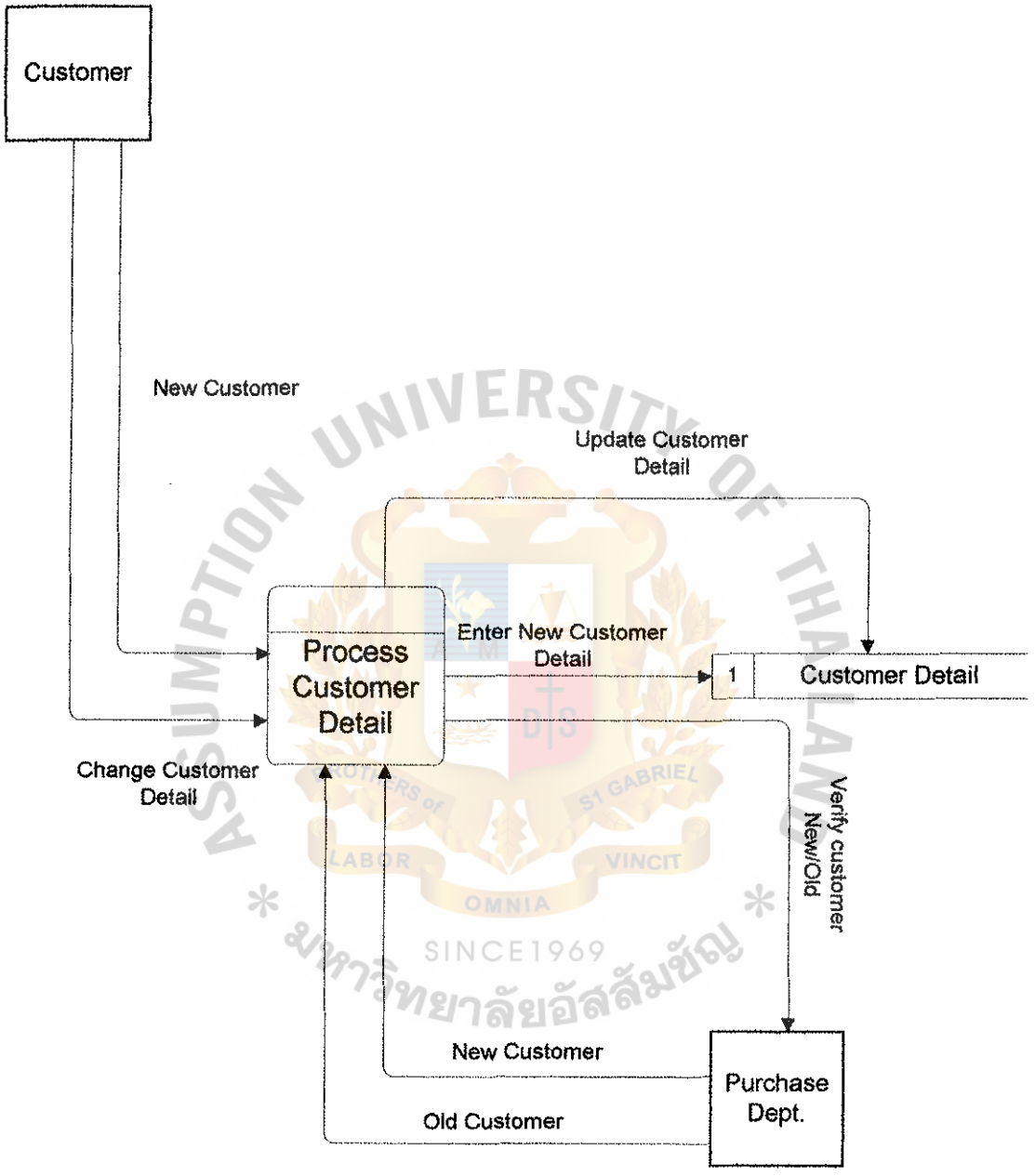


Figure D.1. Customer Detail Process Diagram.

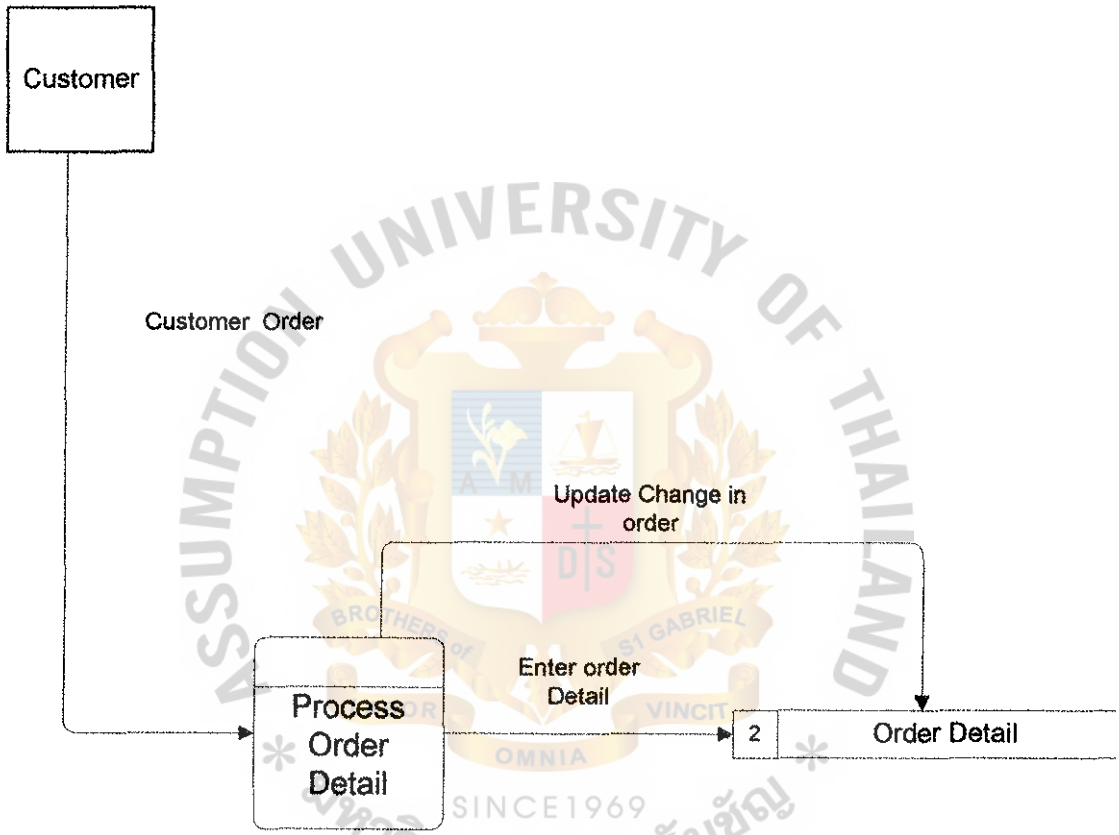


Figure D.2 . Order Detail Process Diagram.

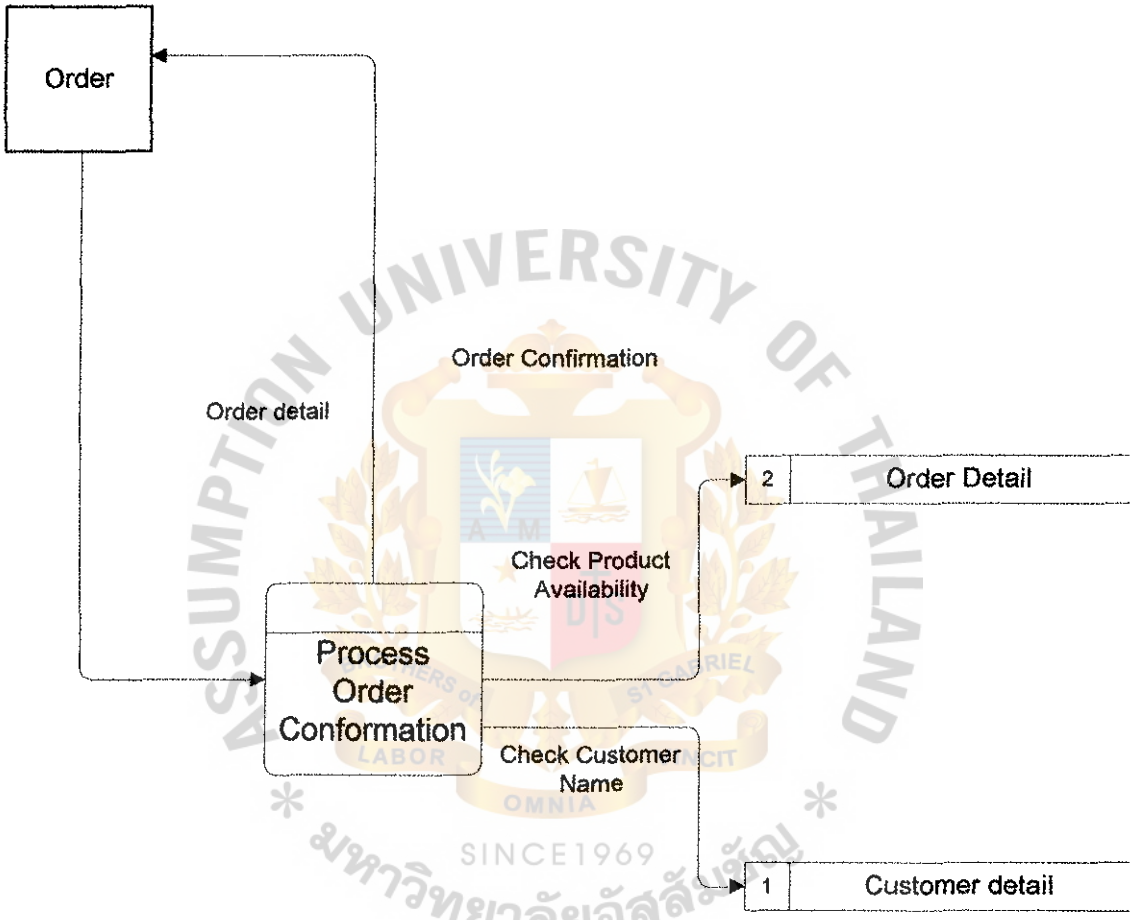


Figure D.3. Order Conformation Process Diagram.

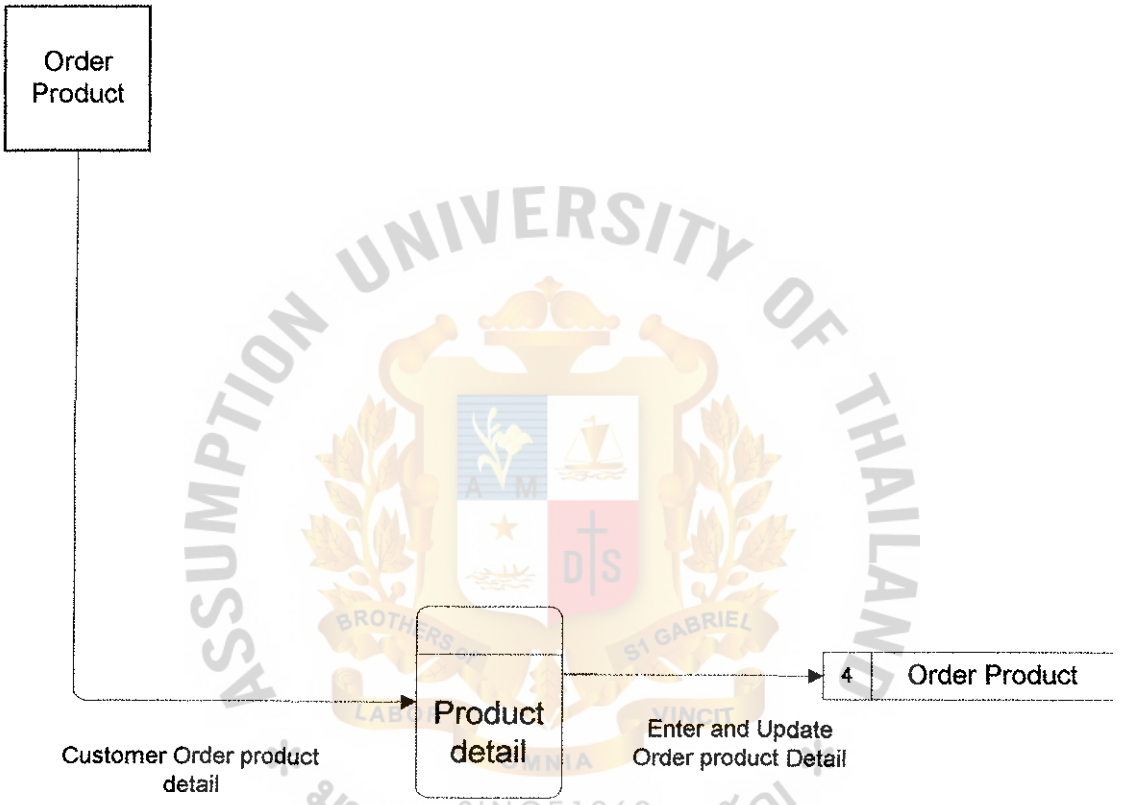


Figure D.4. Product Process Diagram.

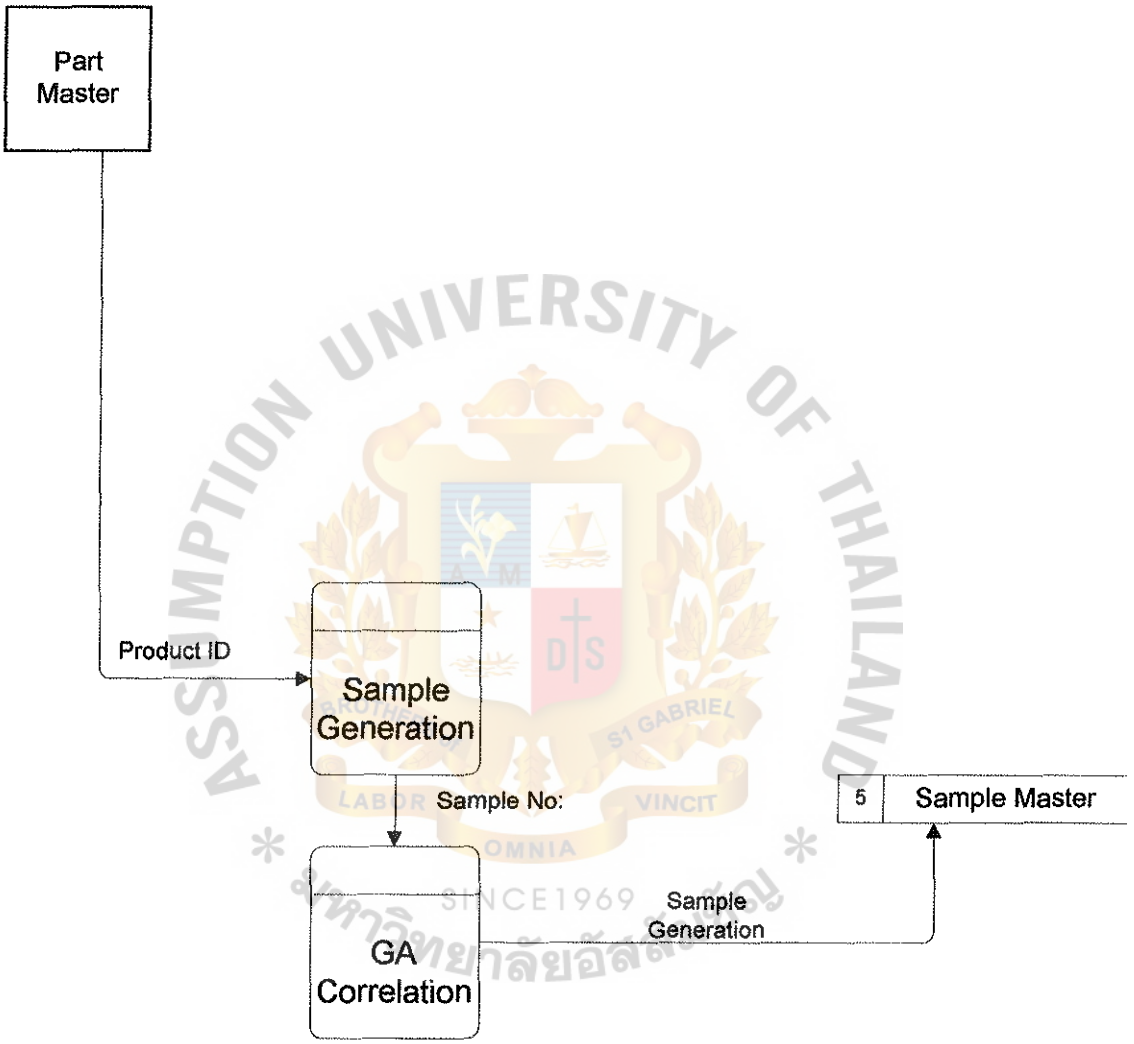


Figure D.5. Sample Generation Diagram.

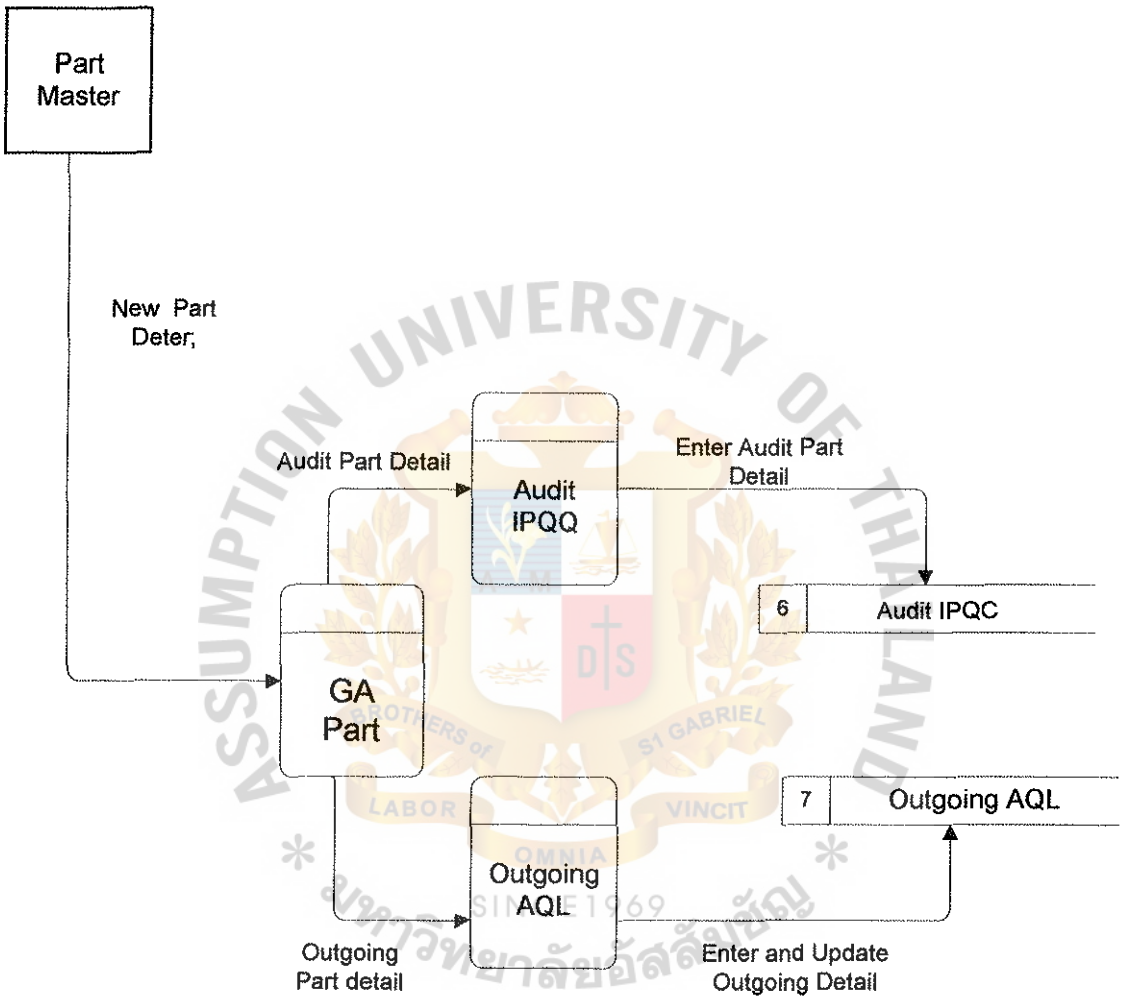


Figure D.6. GA_Part Process Diagram.

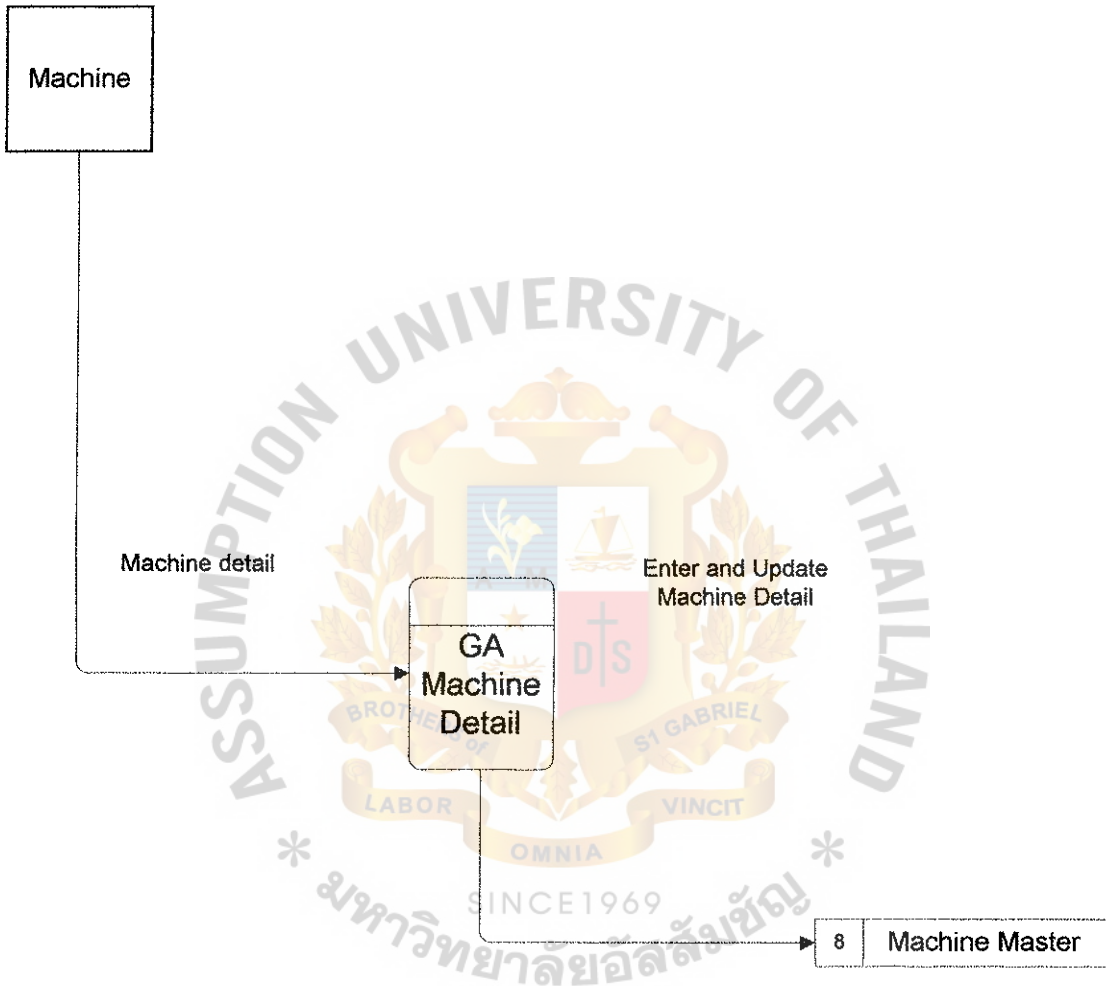


Figure D.7. GA Machine Detail Process Diagram.

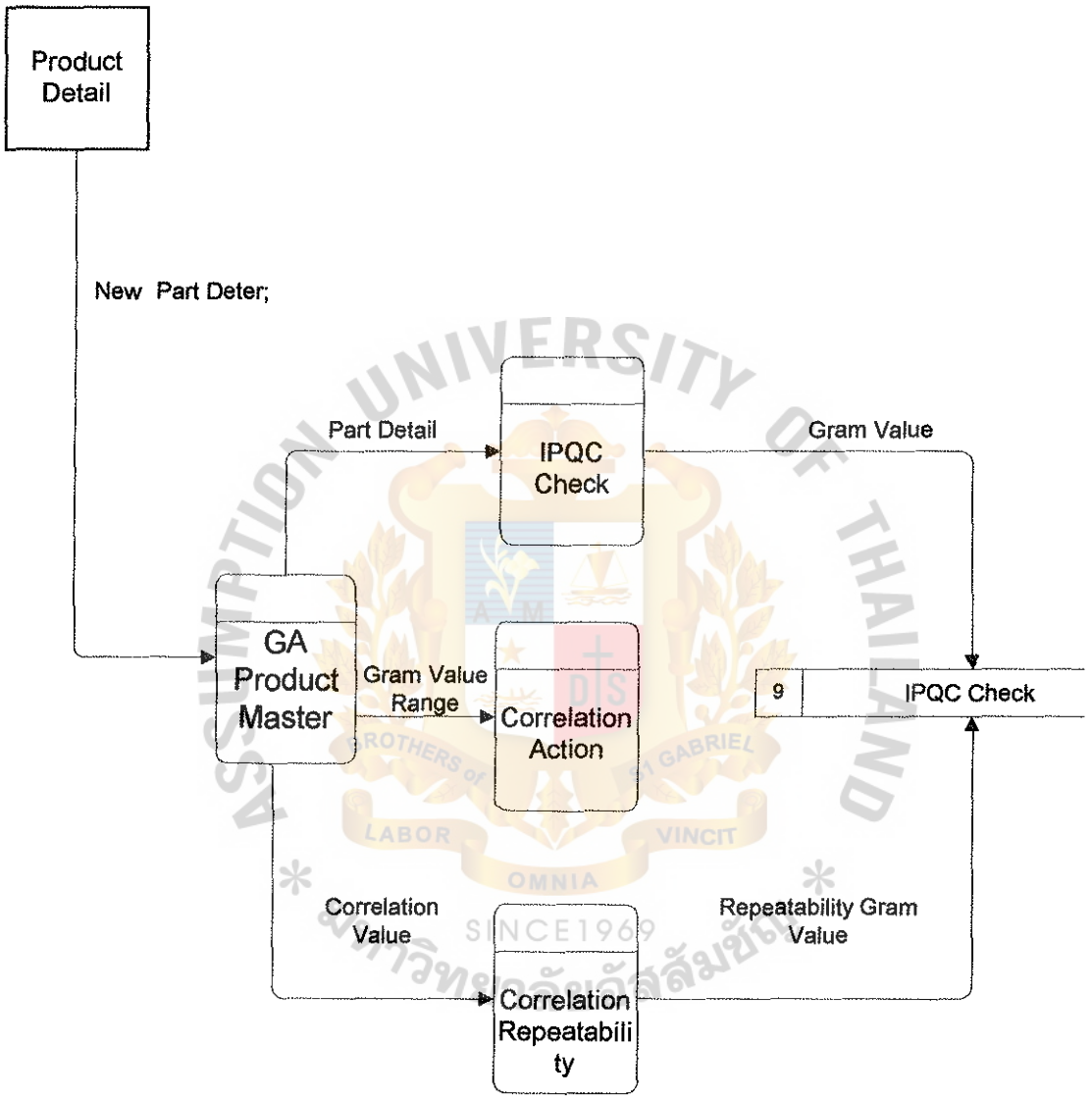


Figure D.8. GA_Production Process Diagram.

APPENDIX E

ENTITY RELATIONAL DIAGRAM

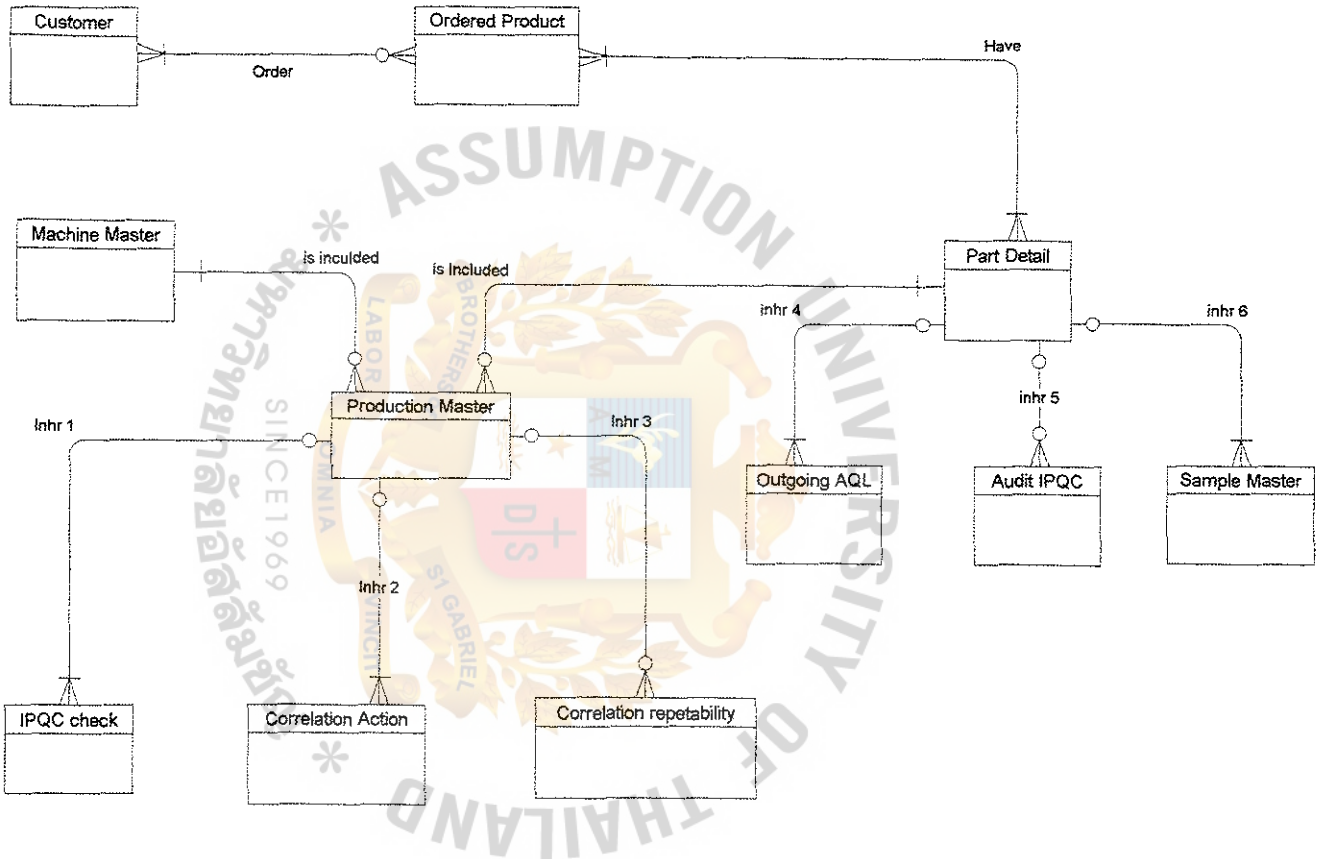


Figure E.1. Context Level Data Model.

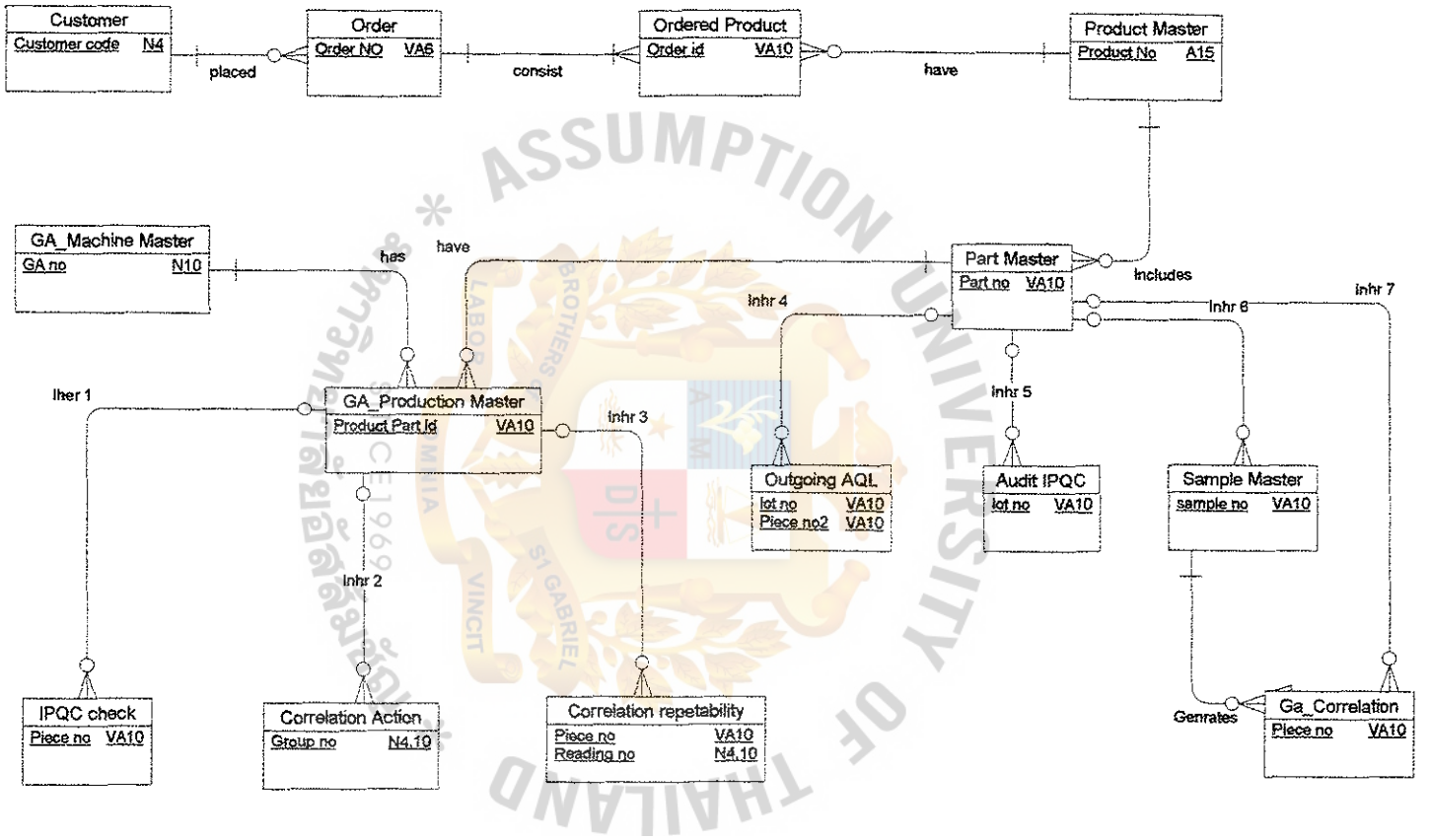


Figure E.2. Key Based Data Model With Generalization Hierarchy.

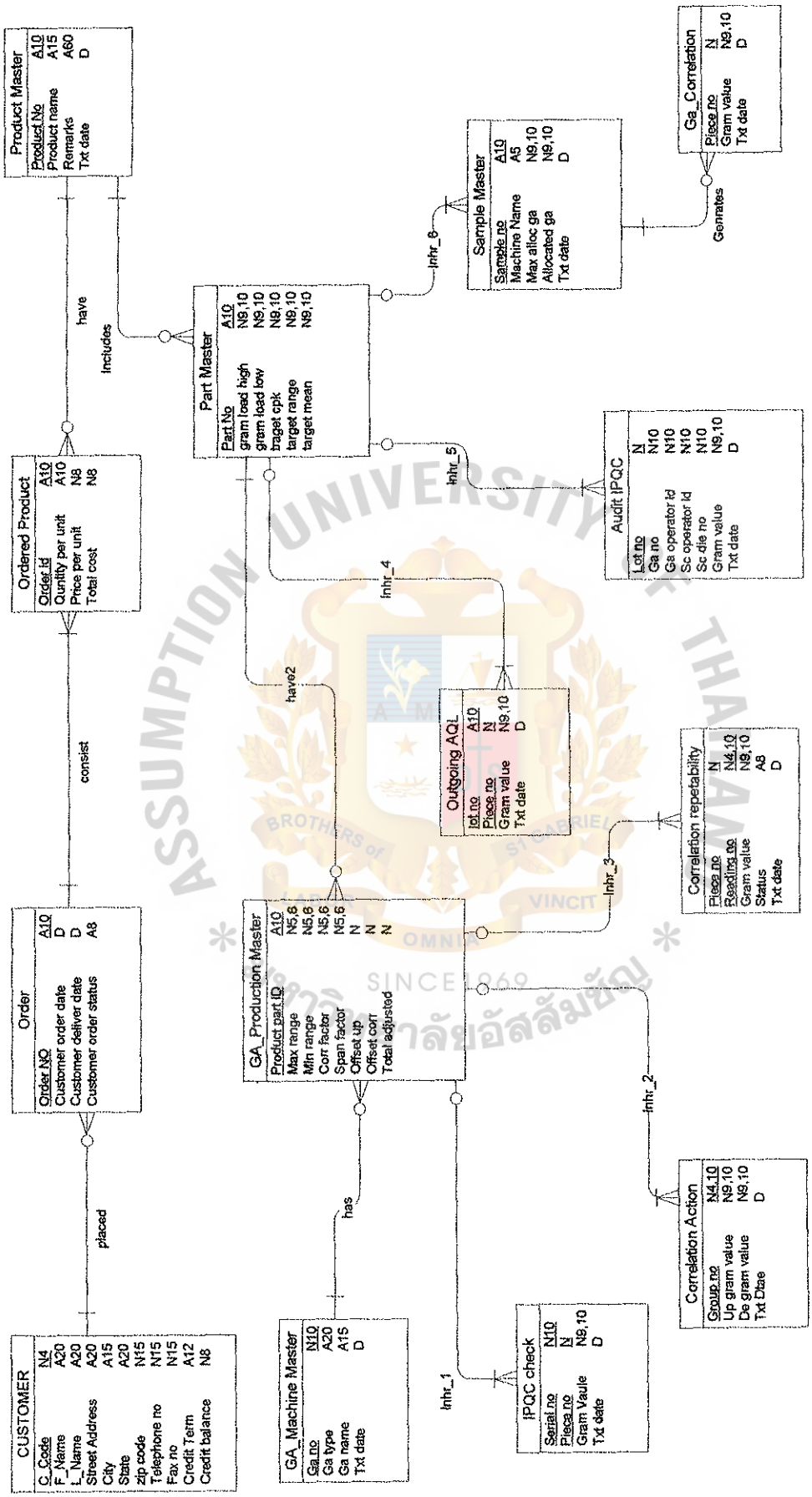


Figure E.3. Fully Attributed Data Model

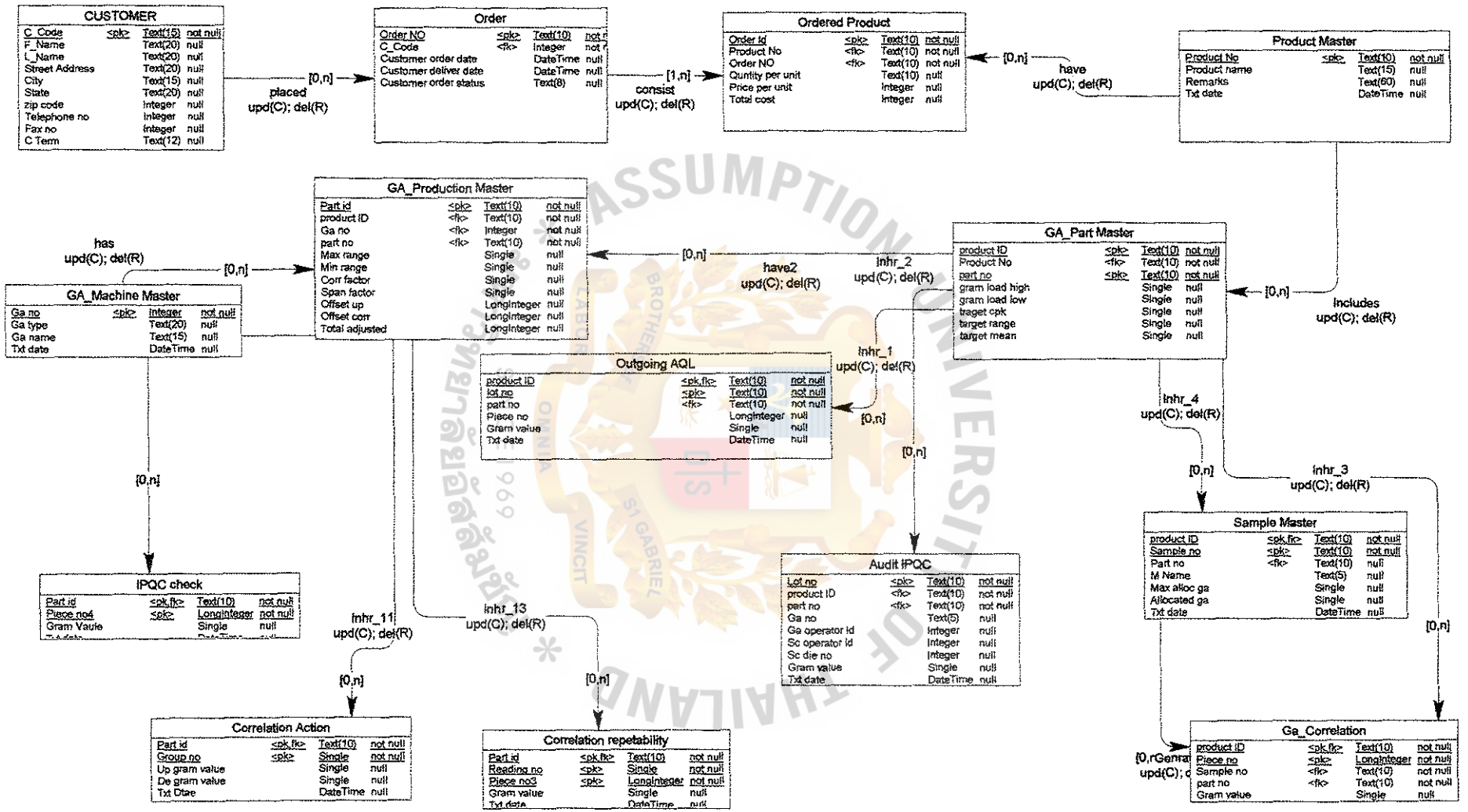


Figure E.4. Physical Data Model.

APPENDIX F

TABLE STRUCTURE

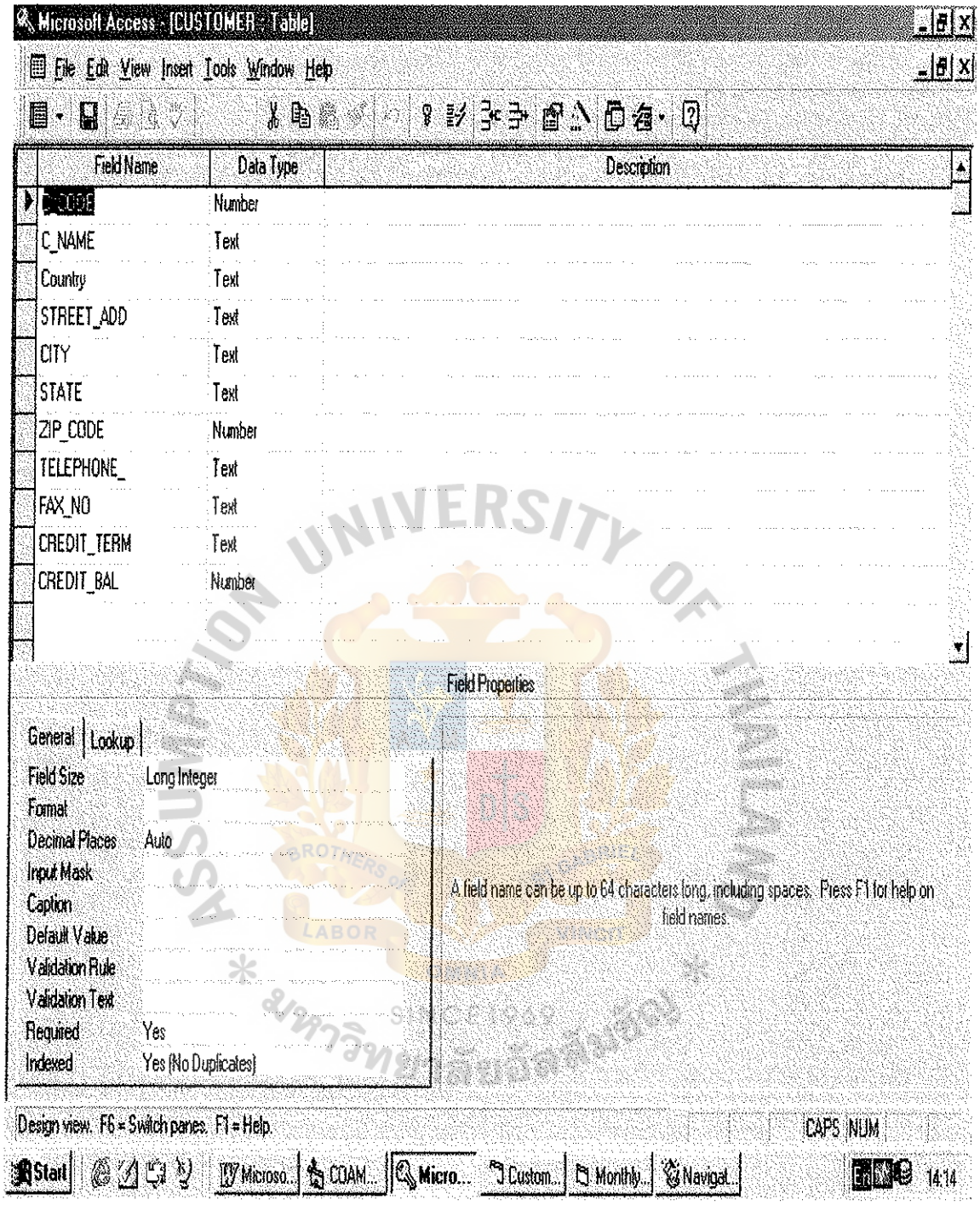


Figure F.1. Table Structure.

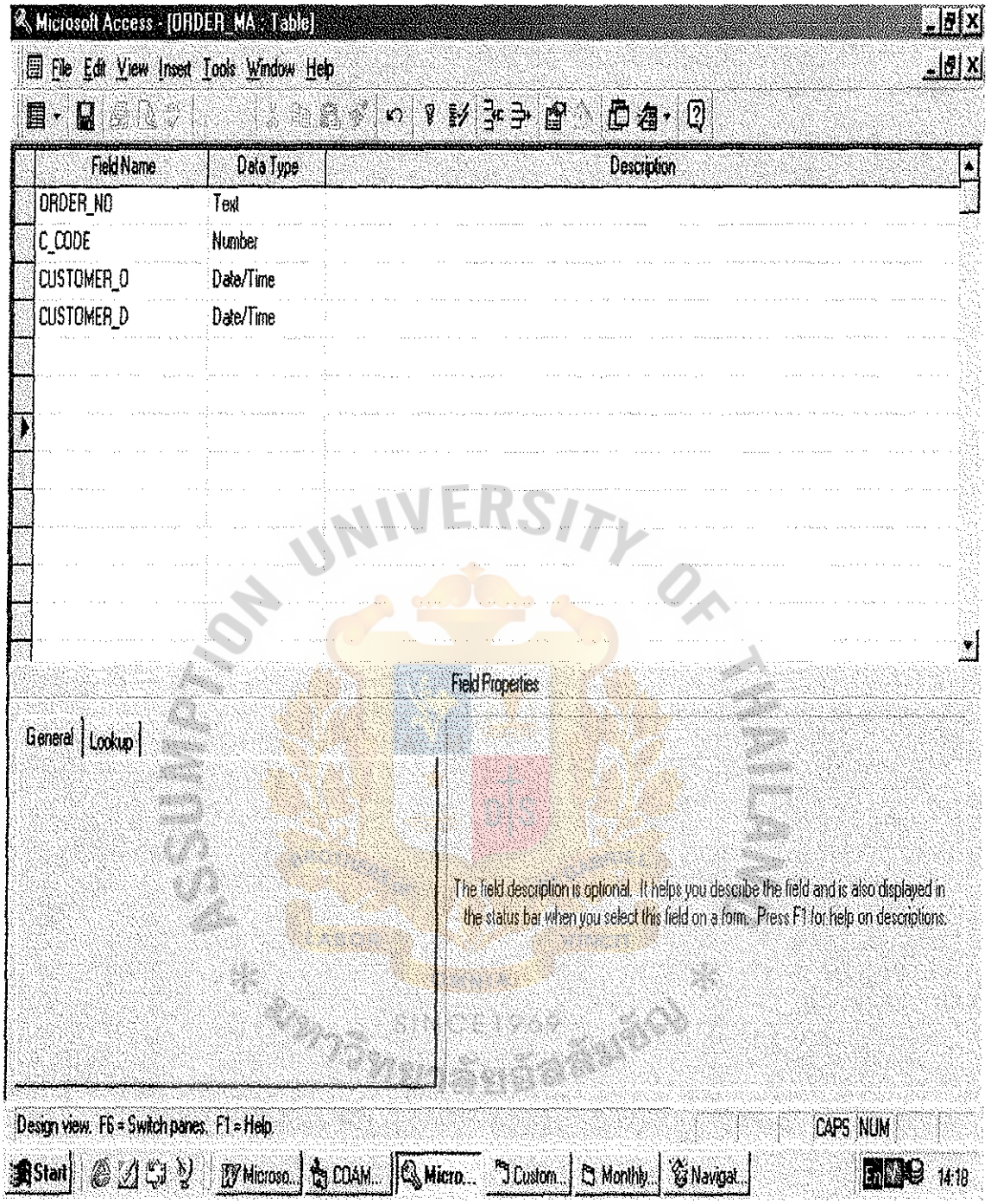
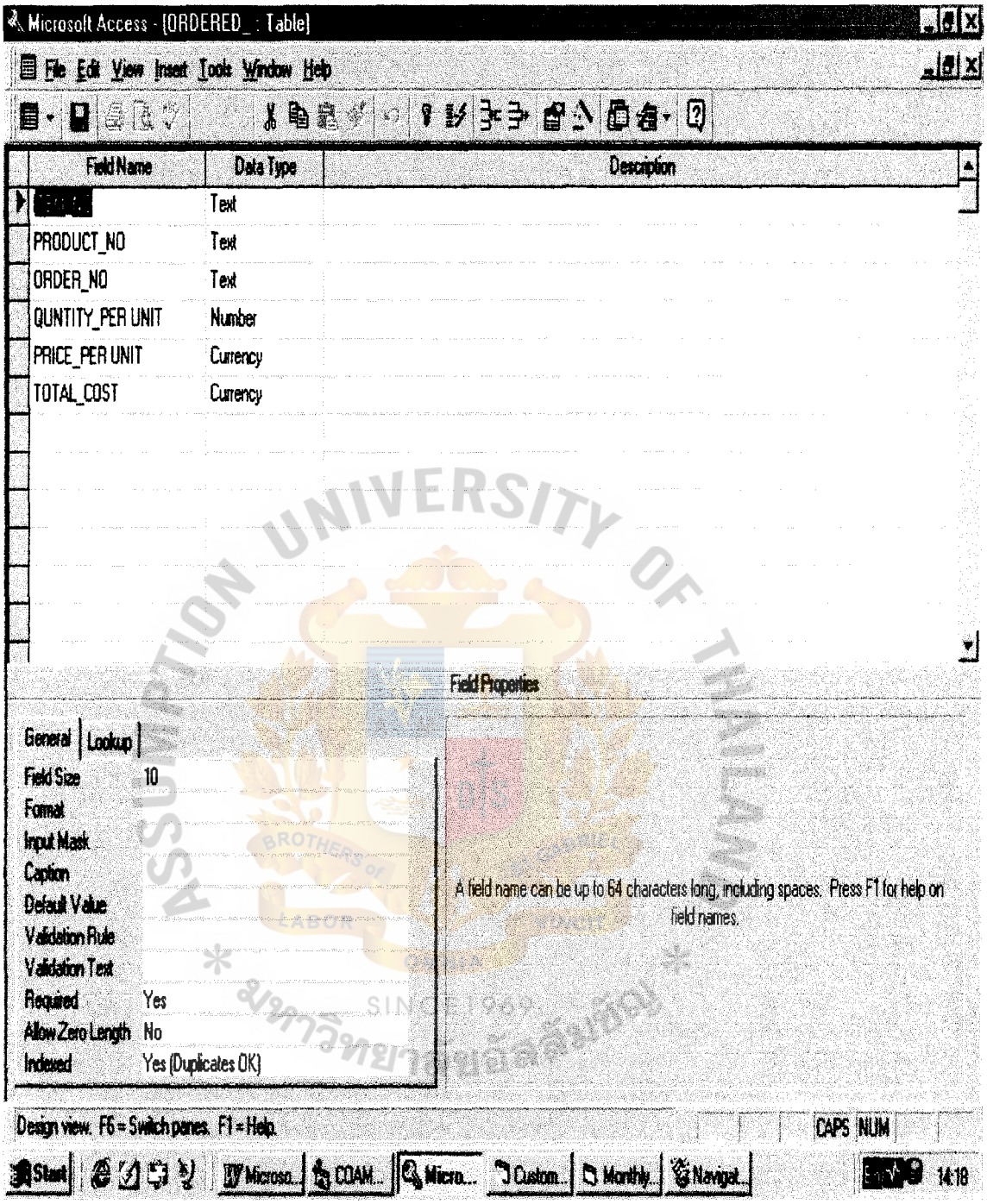


Figure F.2. Table Structure (Continued).



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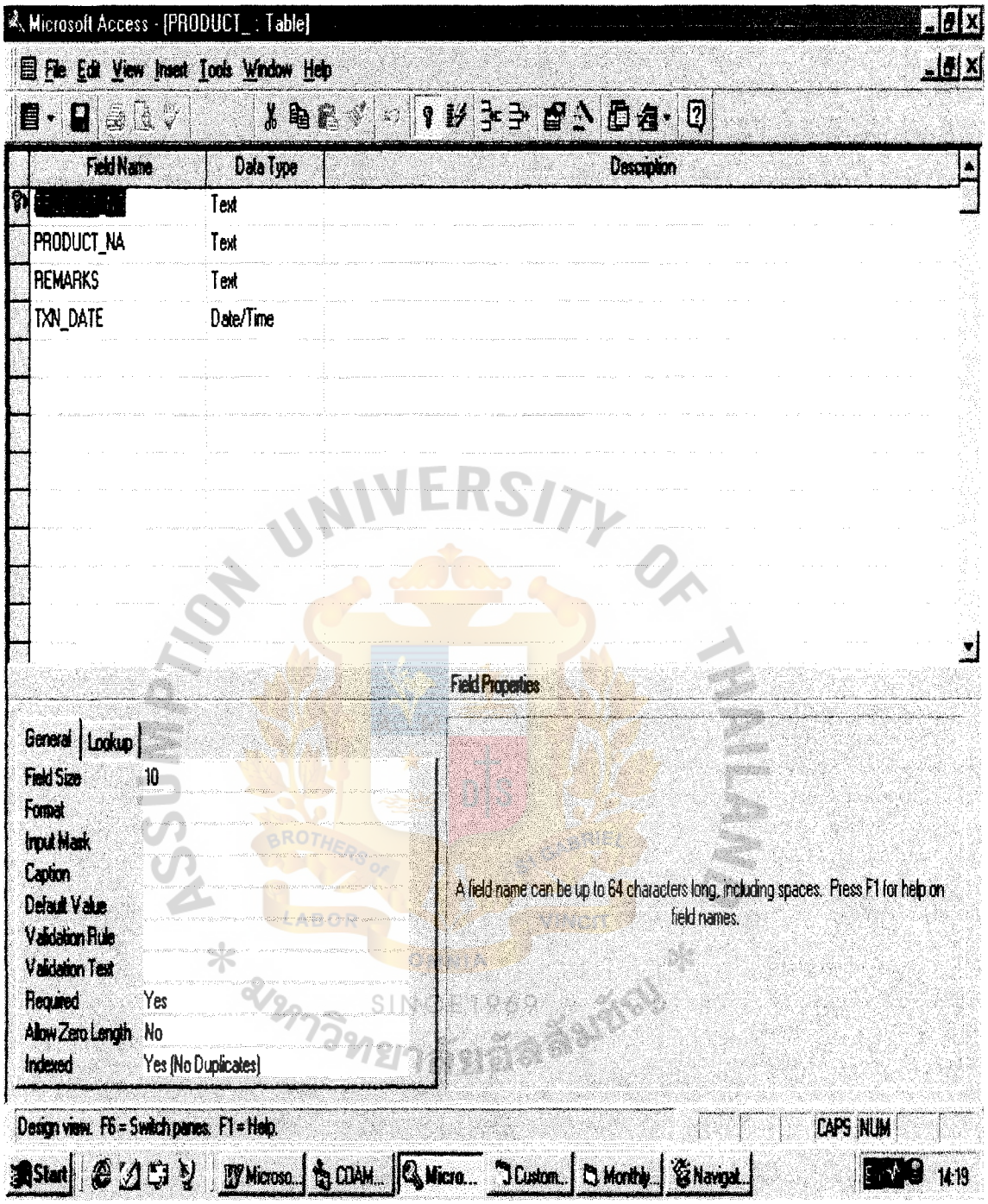

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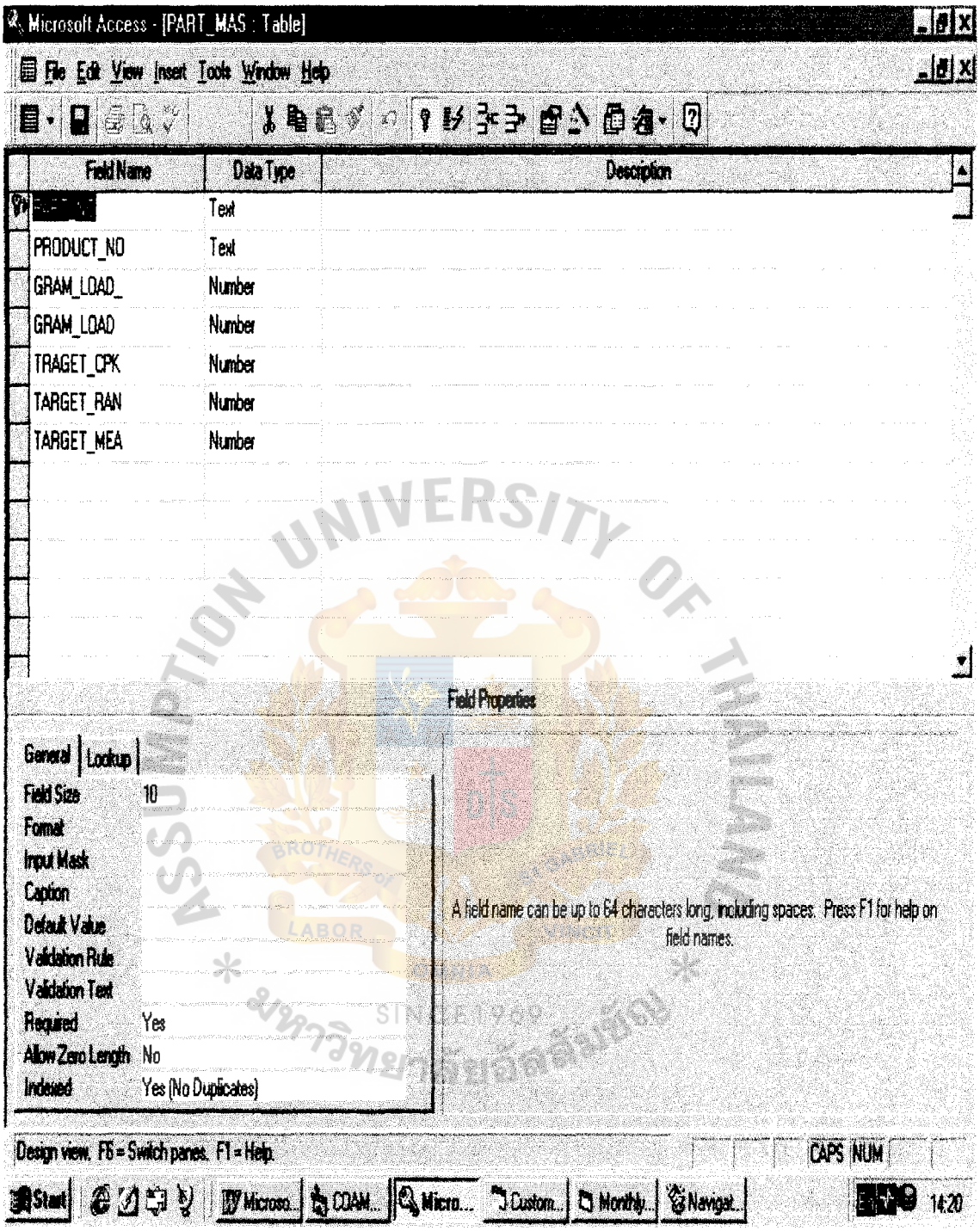

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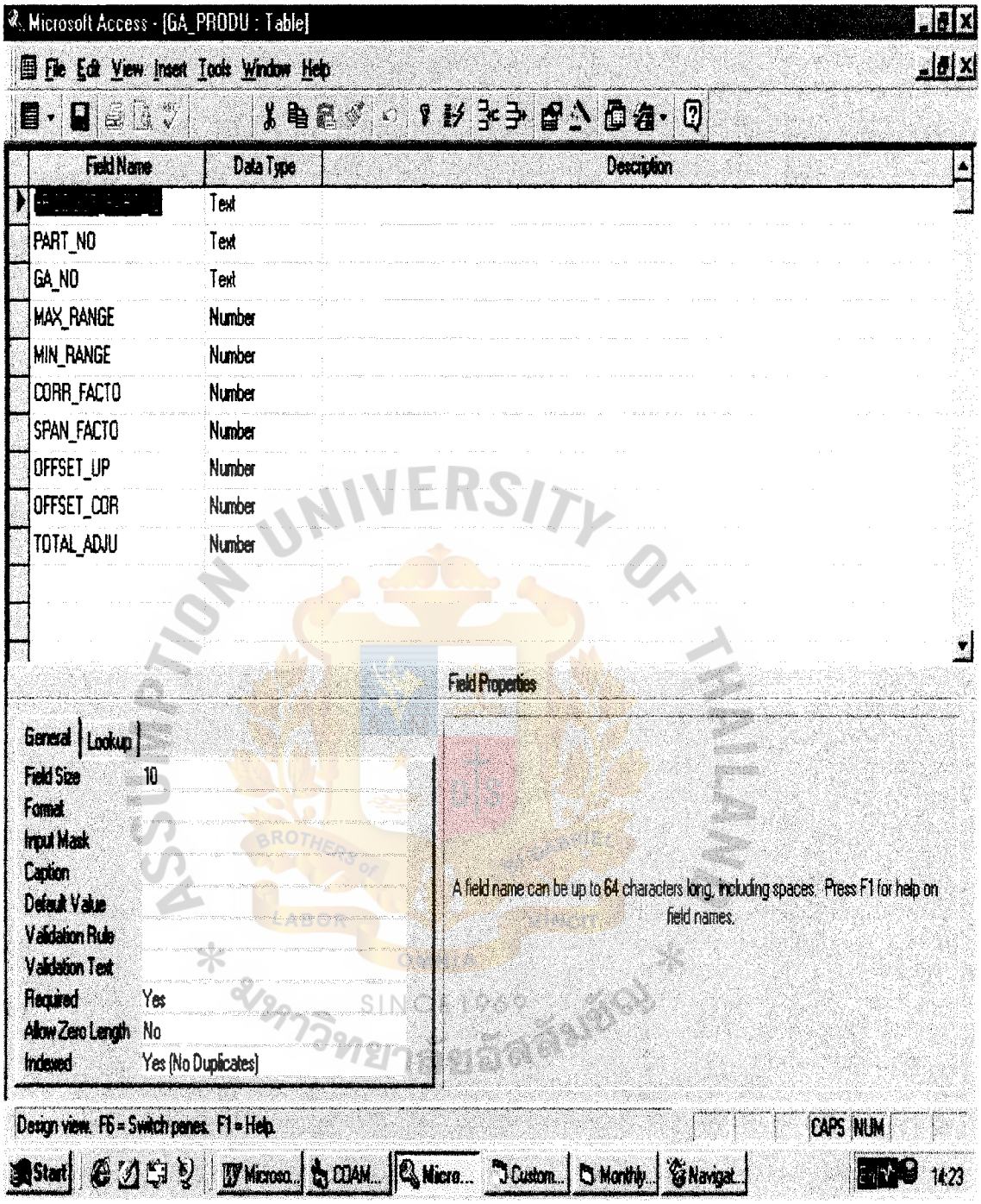

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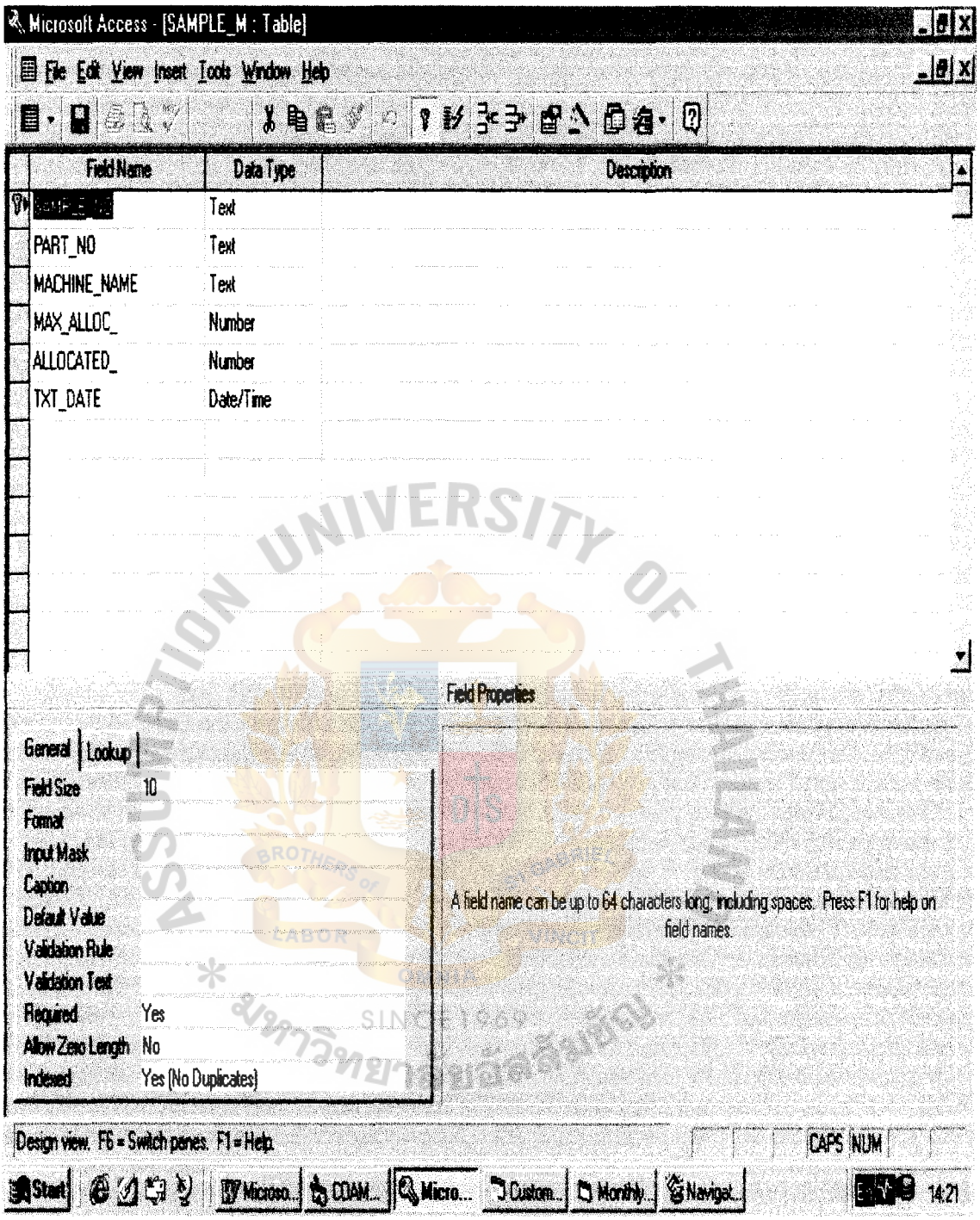

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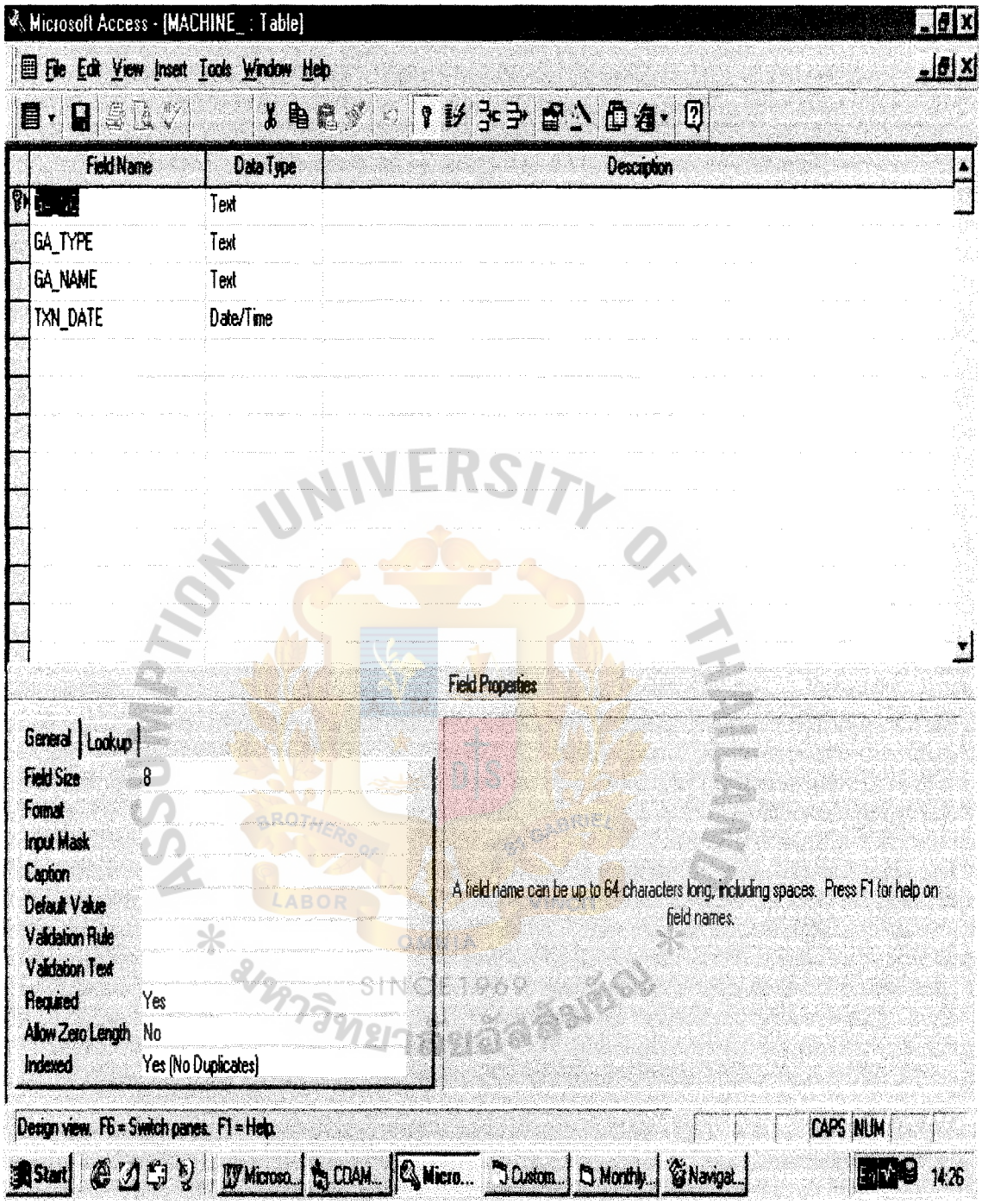

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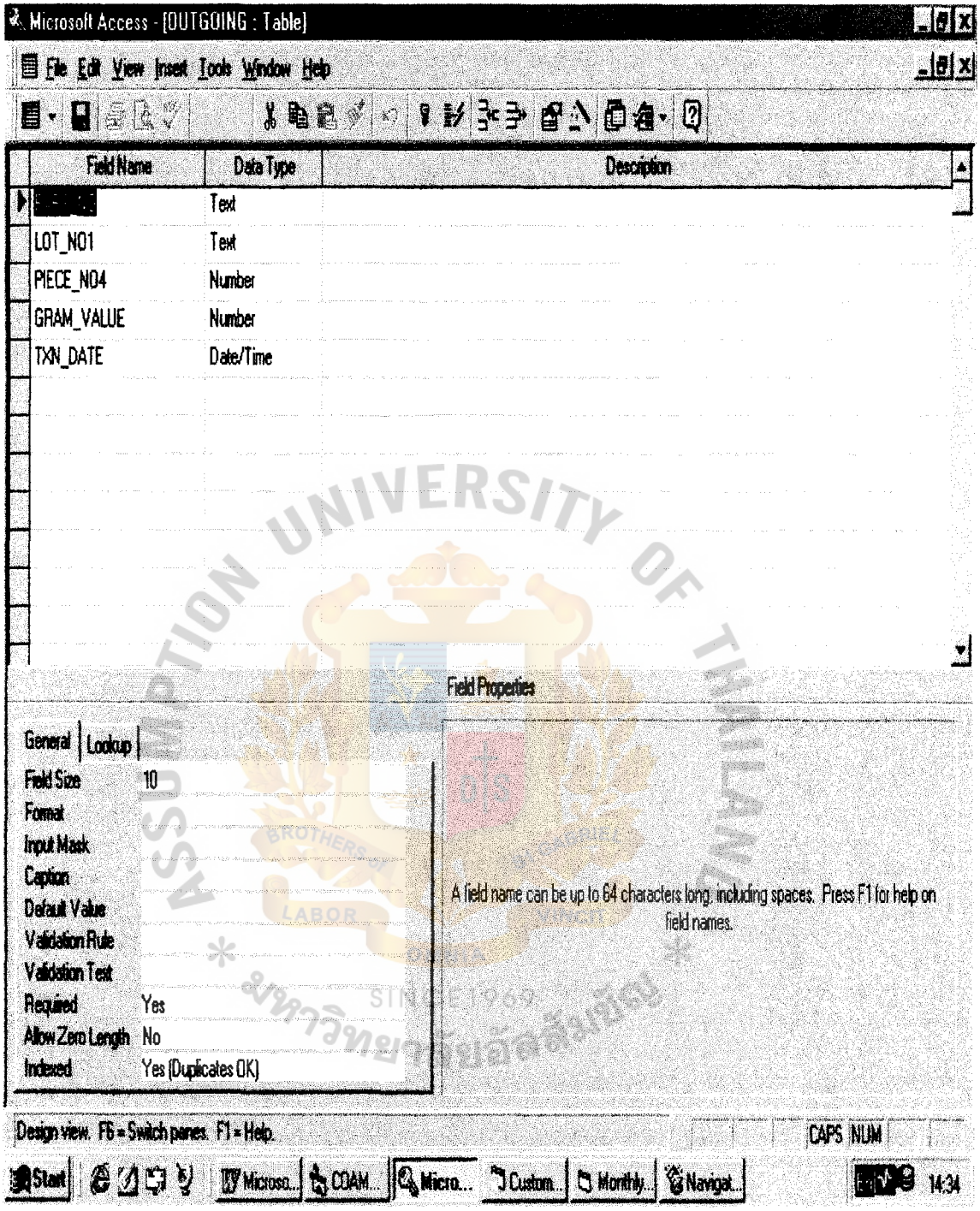

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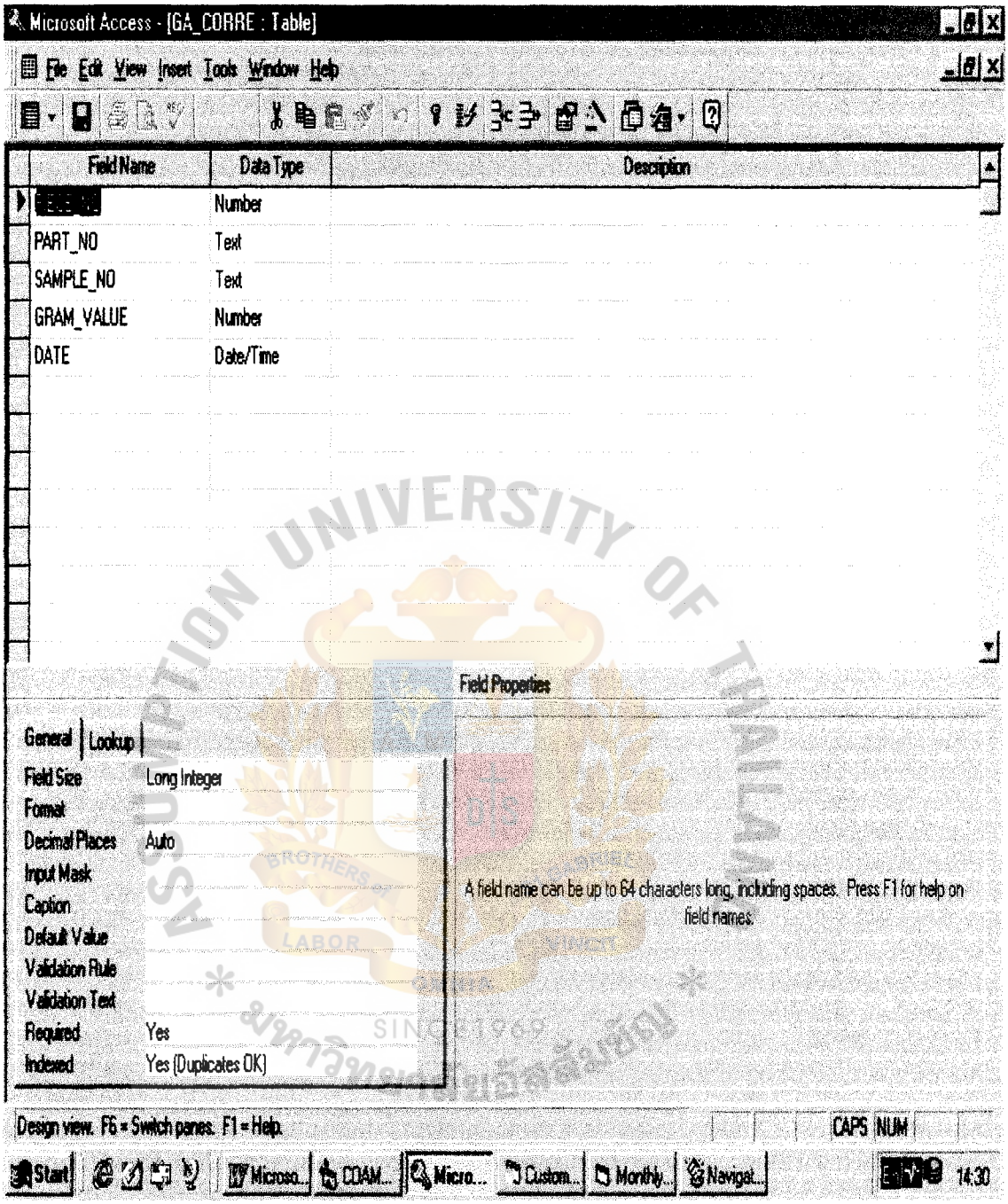

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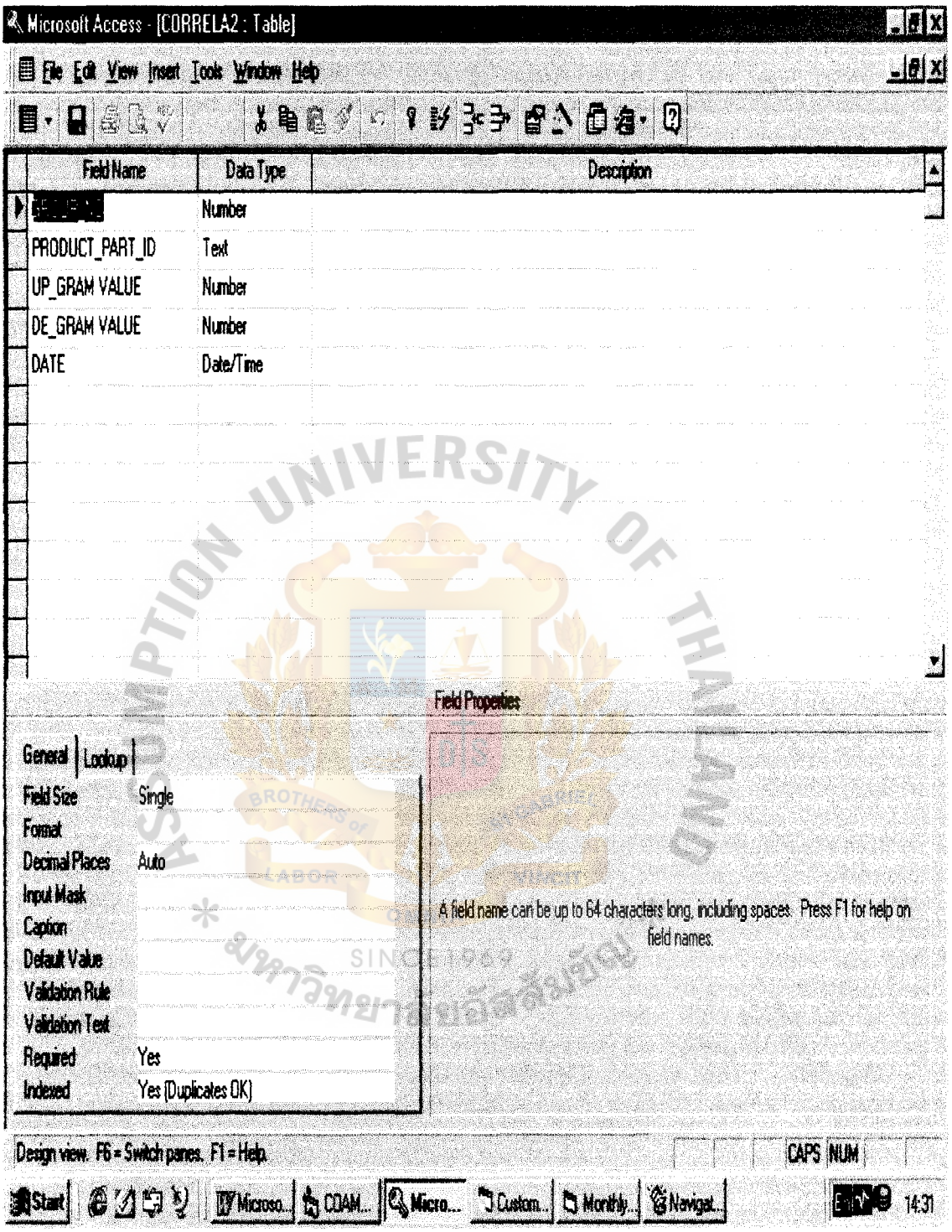

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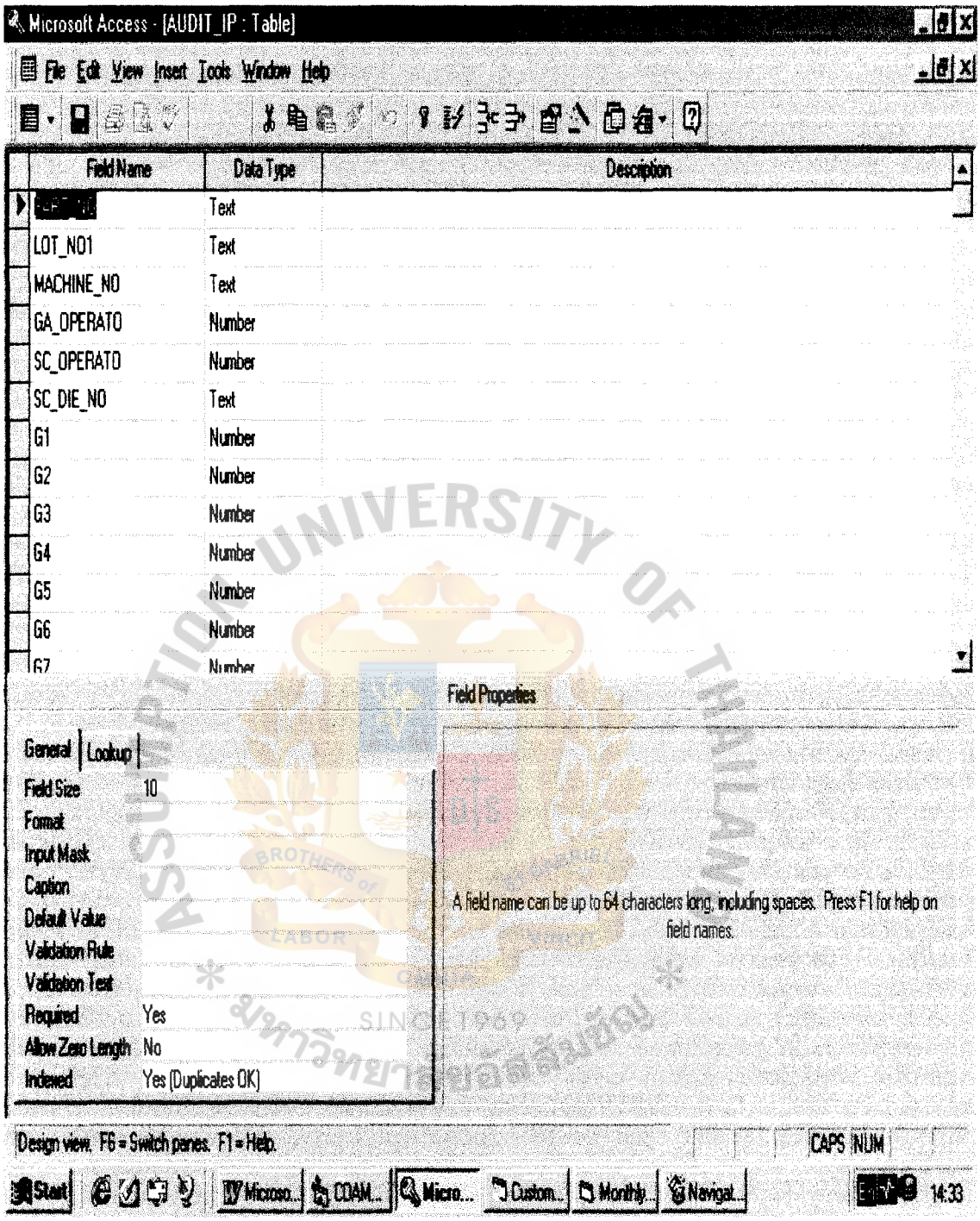


Figure F.12. Table Structure (Continued).

APPENDIX G

MAIN MENU SCREEN

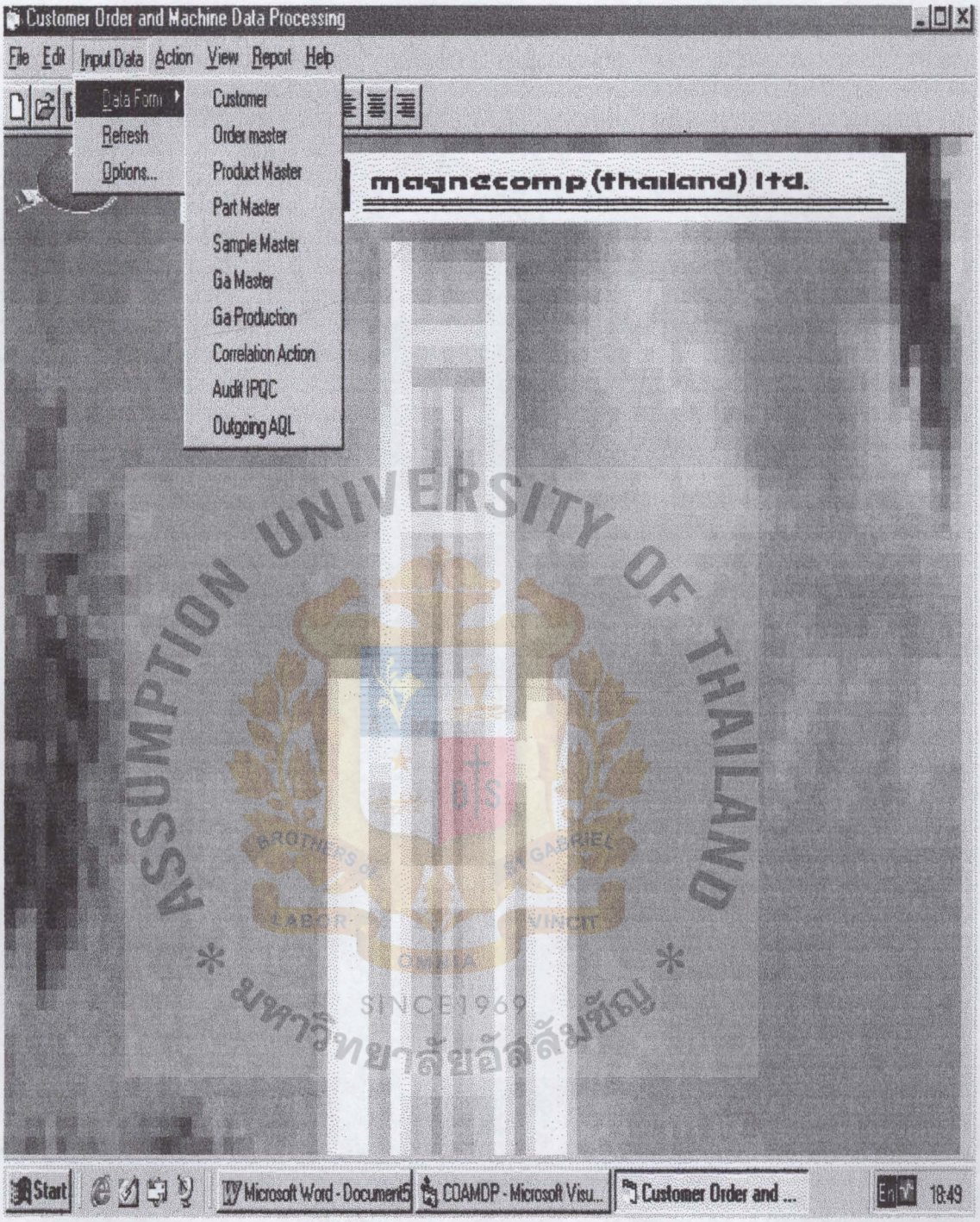


Figure G.1. Main Menu Screen.

APPENDIX H

INPUT SCREEN DESIGN

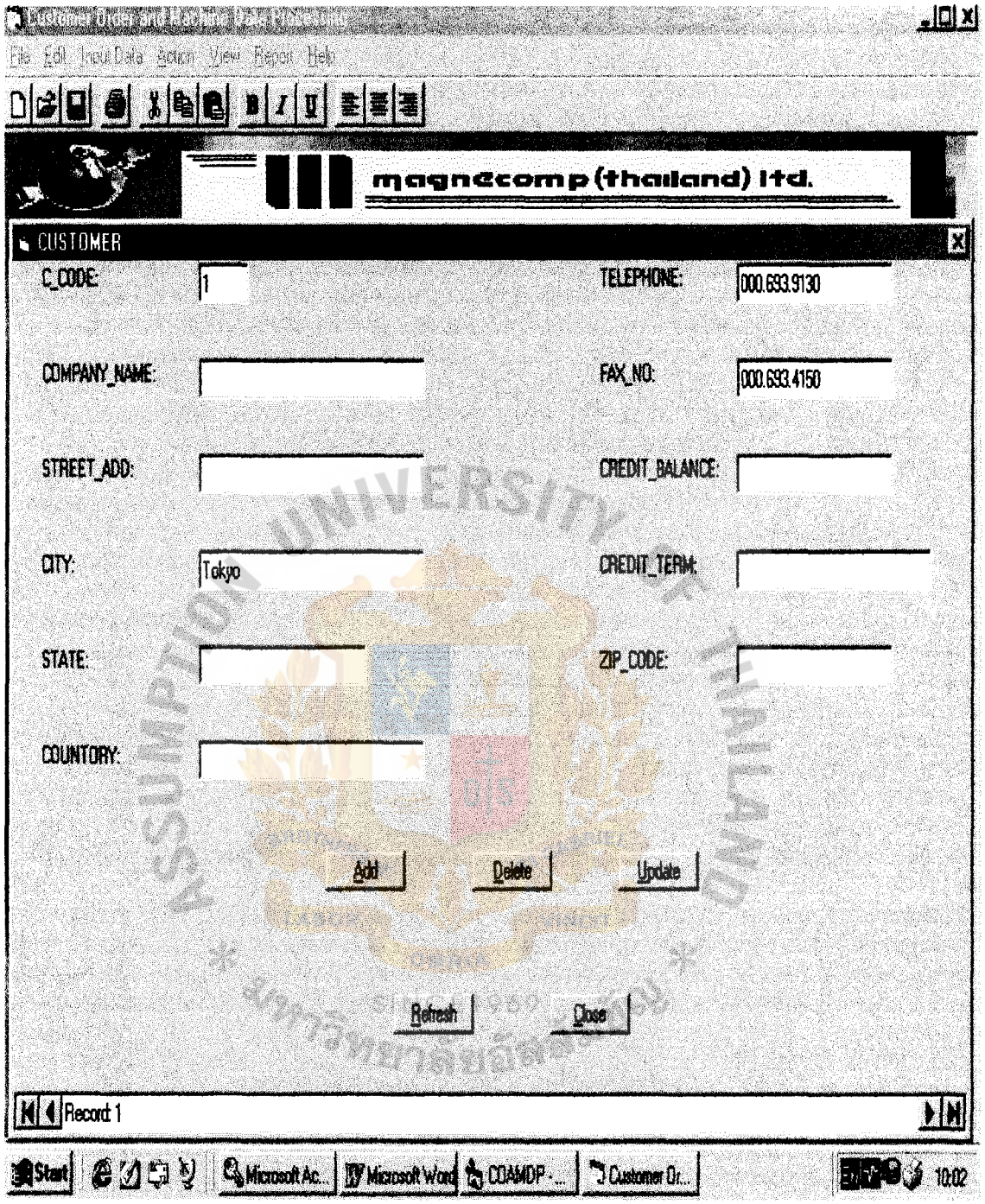


Figure H.1. Input Screen for Customer Detail.

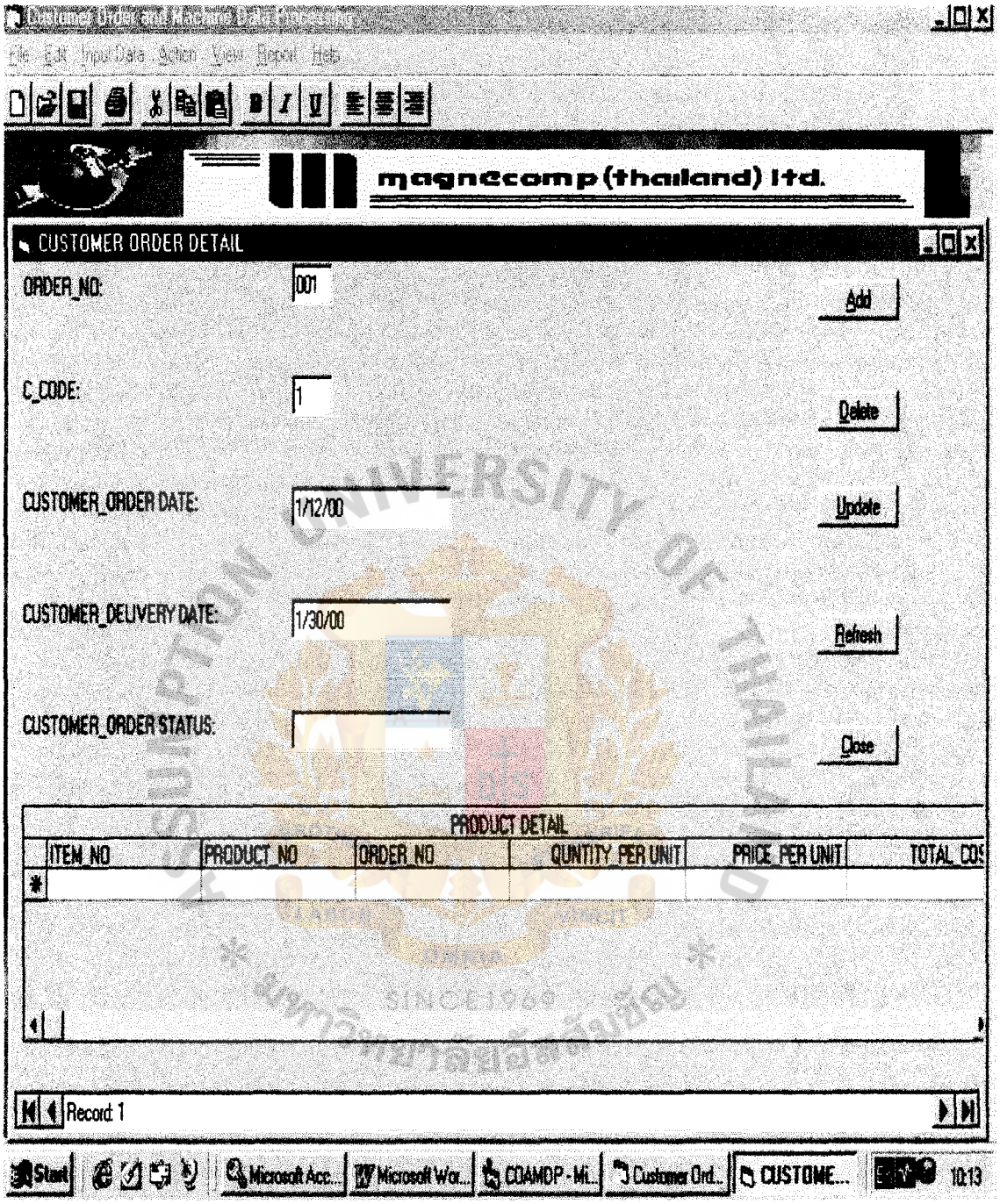


Figure H.2. Input Screen for Customer Order Detail.

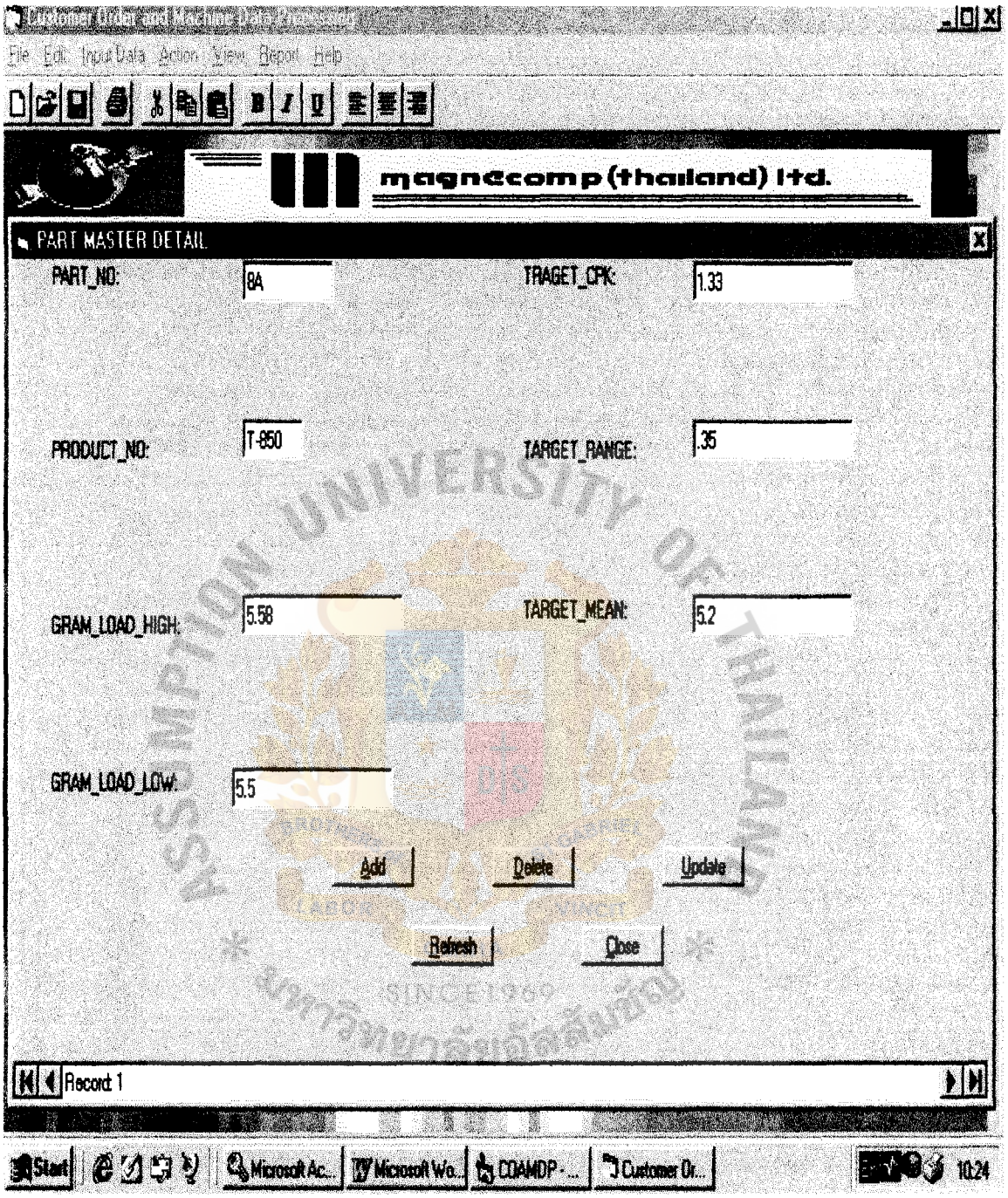


Figure H.3. Input Screen for Product Detail.

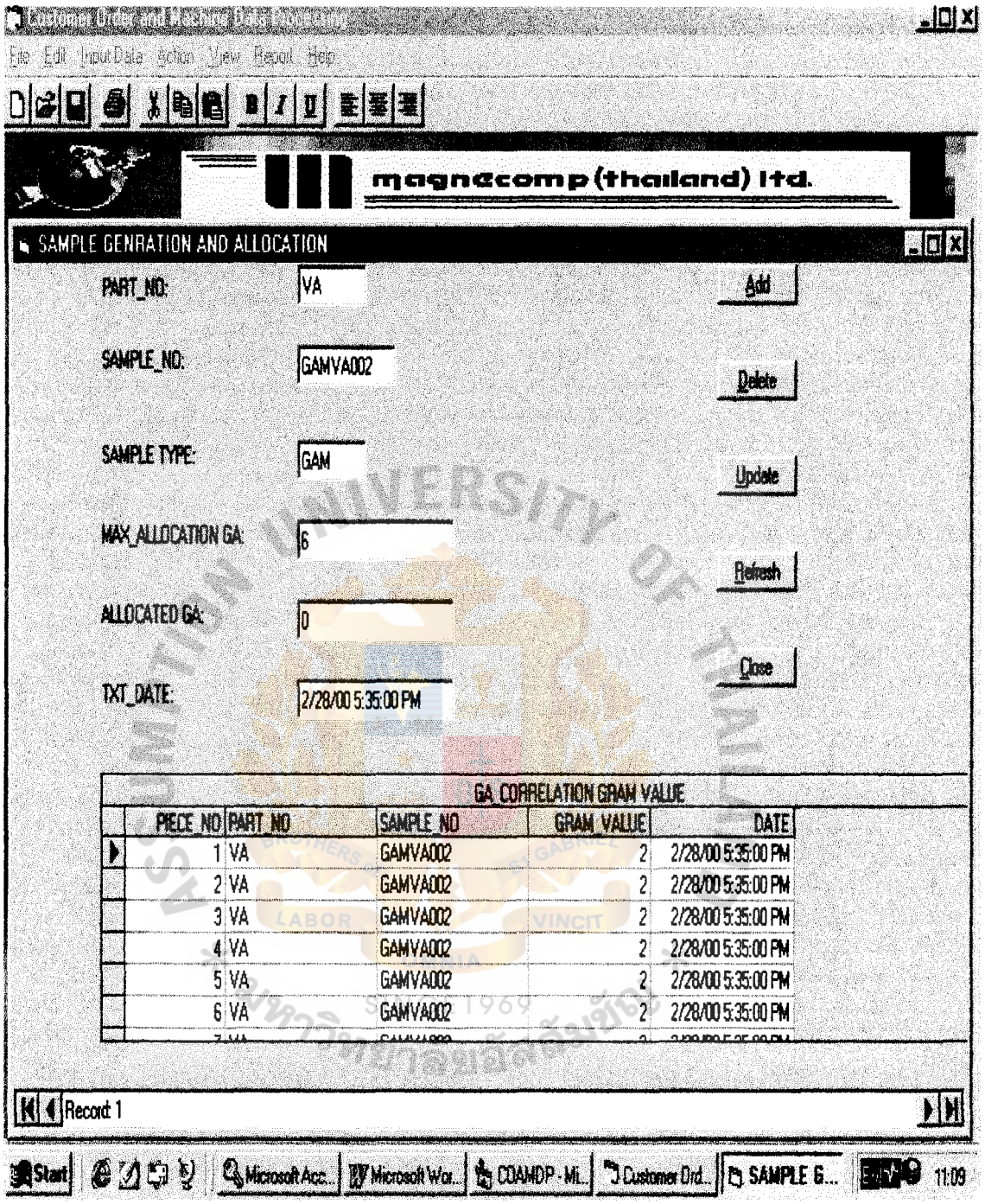


Figure H.4. Input Screen for Sample Generation and Allocation.

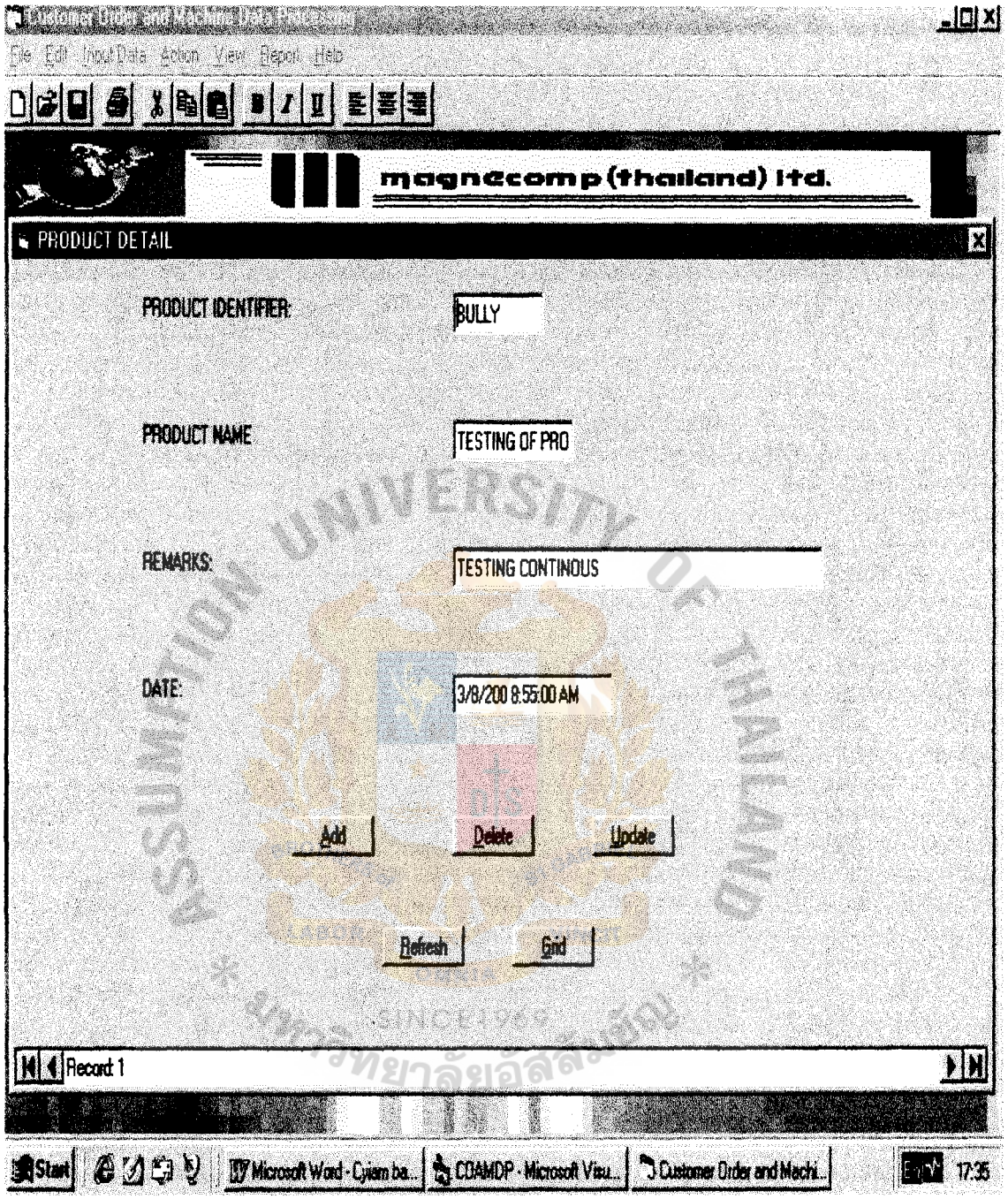


Figure H.5. Input Screen for Product Detail.

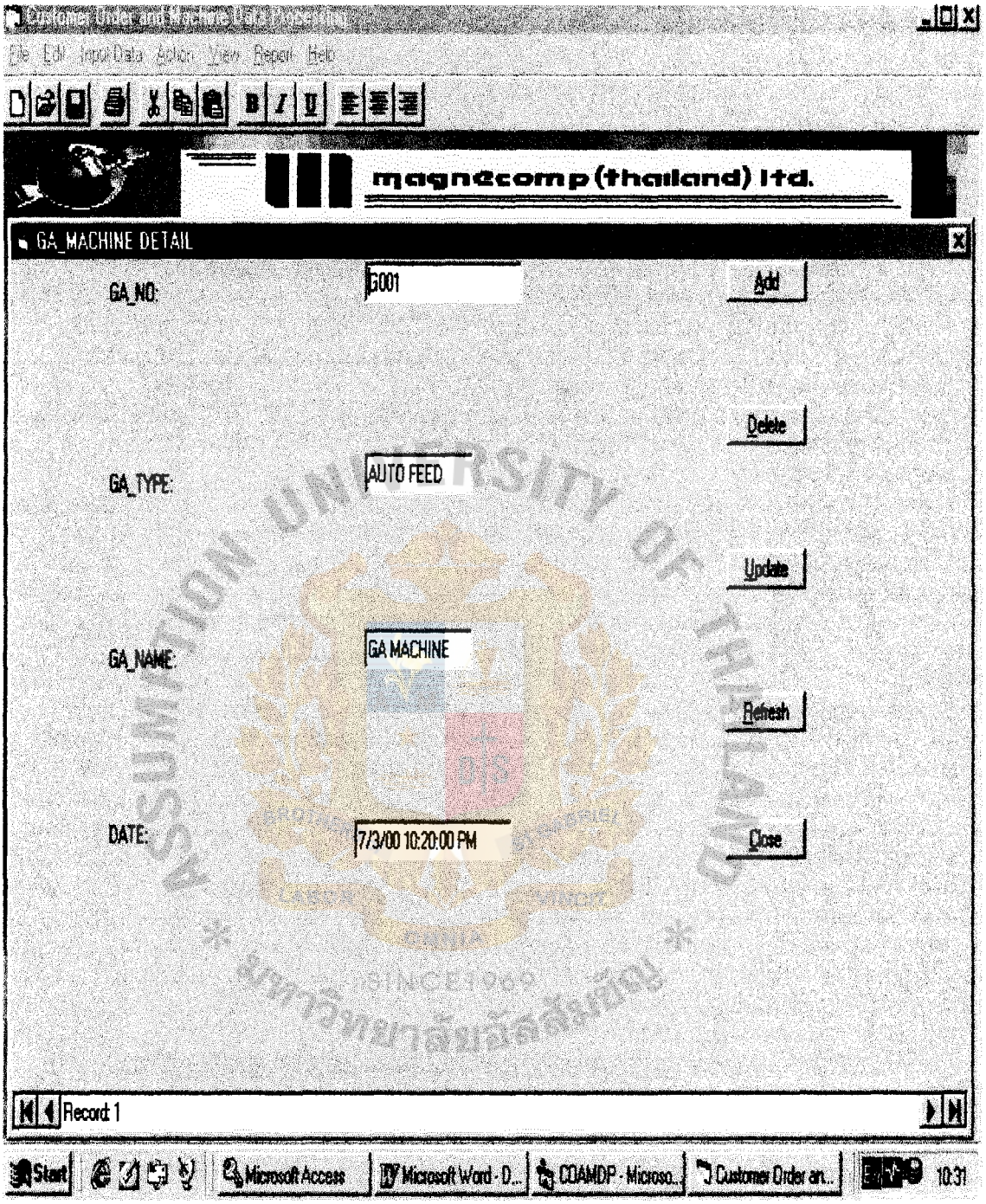


Figure H.6. Input Screen for GA Machine Detail.

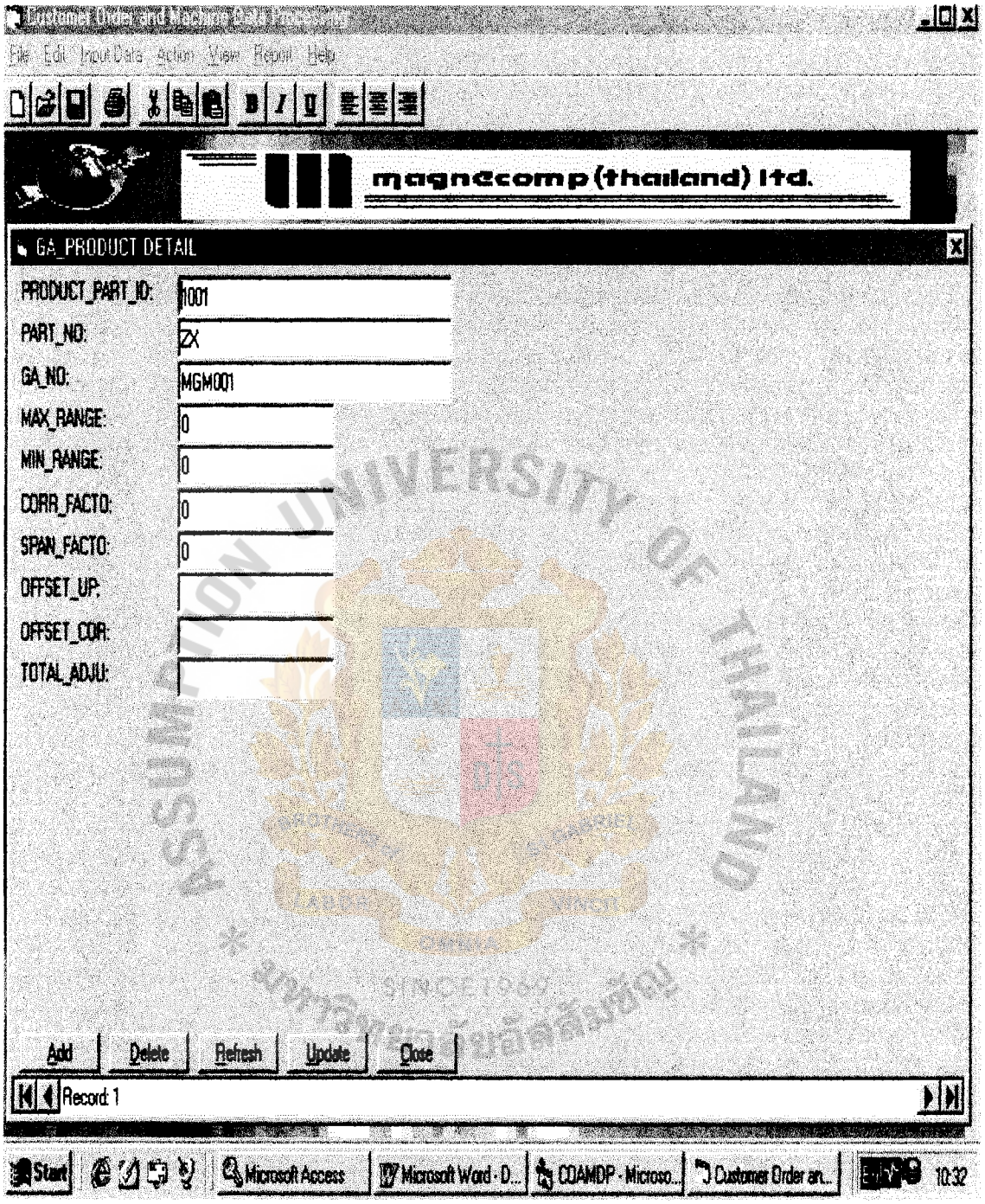


Figure H.7. Input Screen for GA Production Detail.

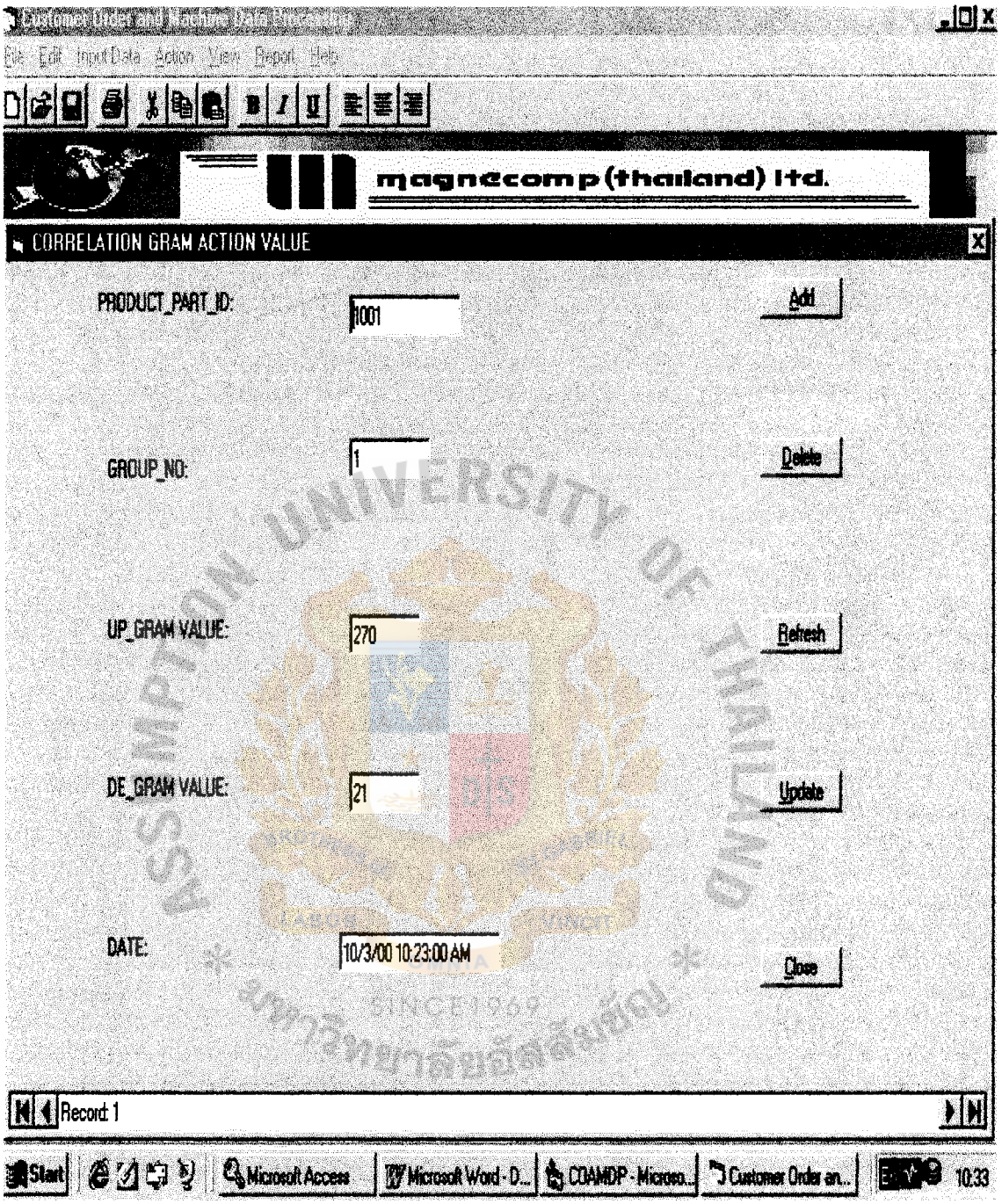


Figure H.8. Input Screen for Correlation Gram Action Value.

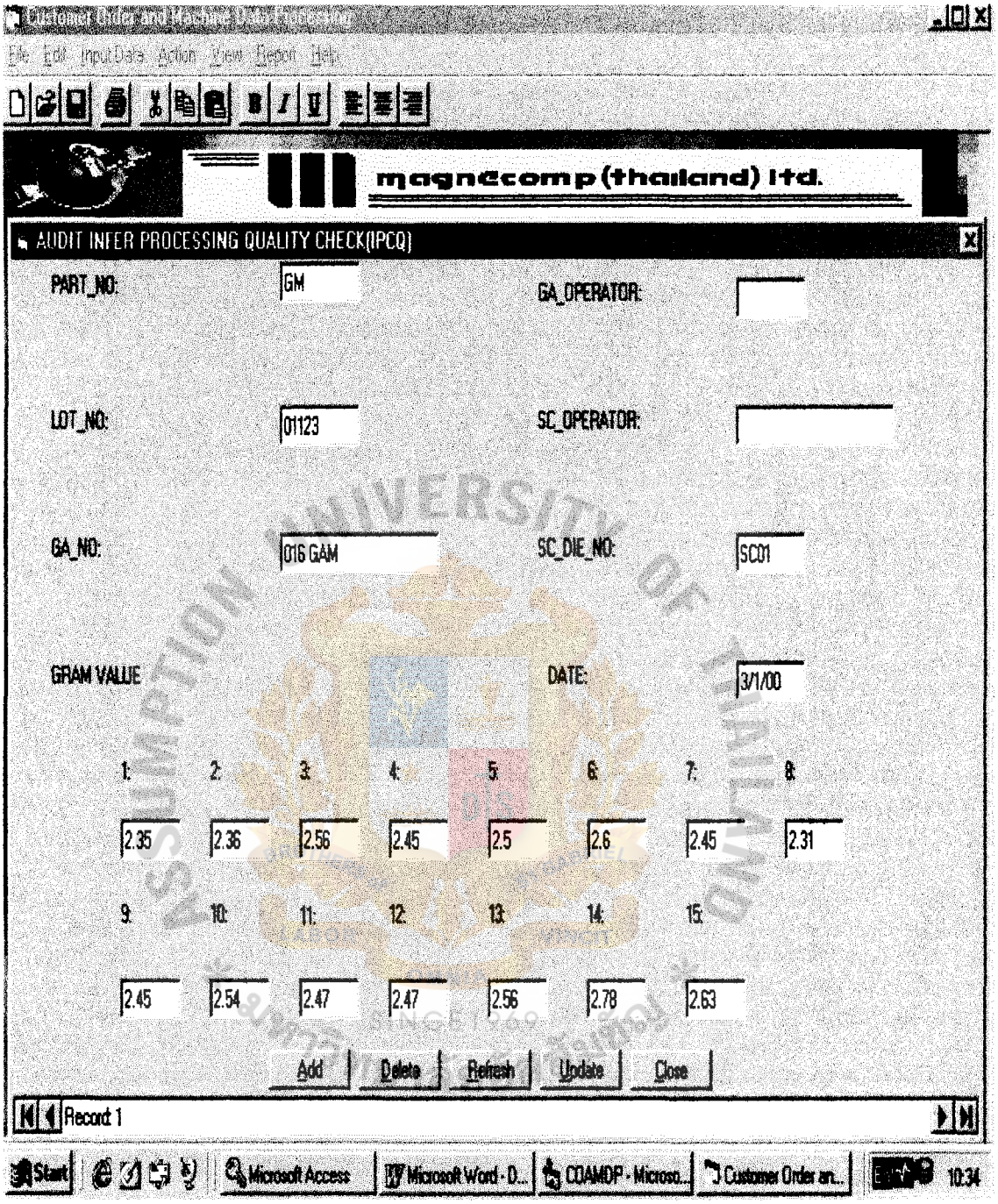


Figure H.9. Input Screen for Audit IPQC.

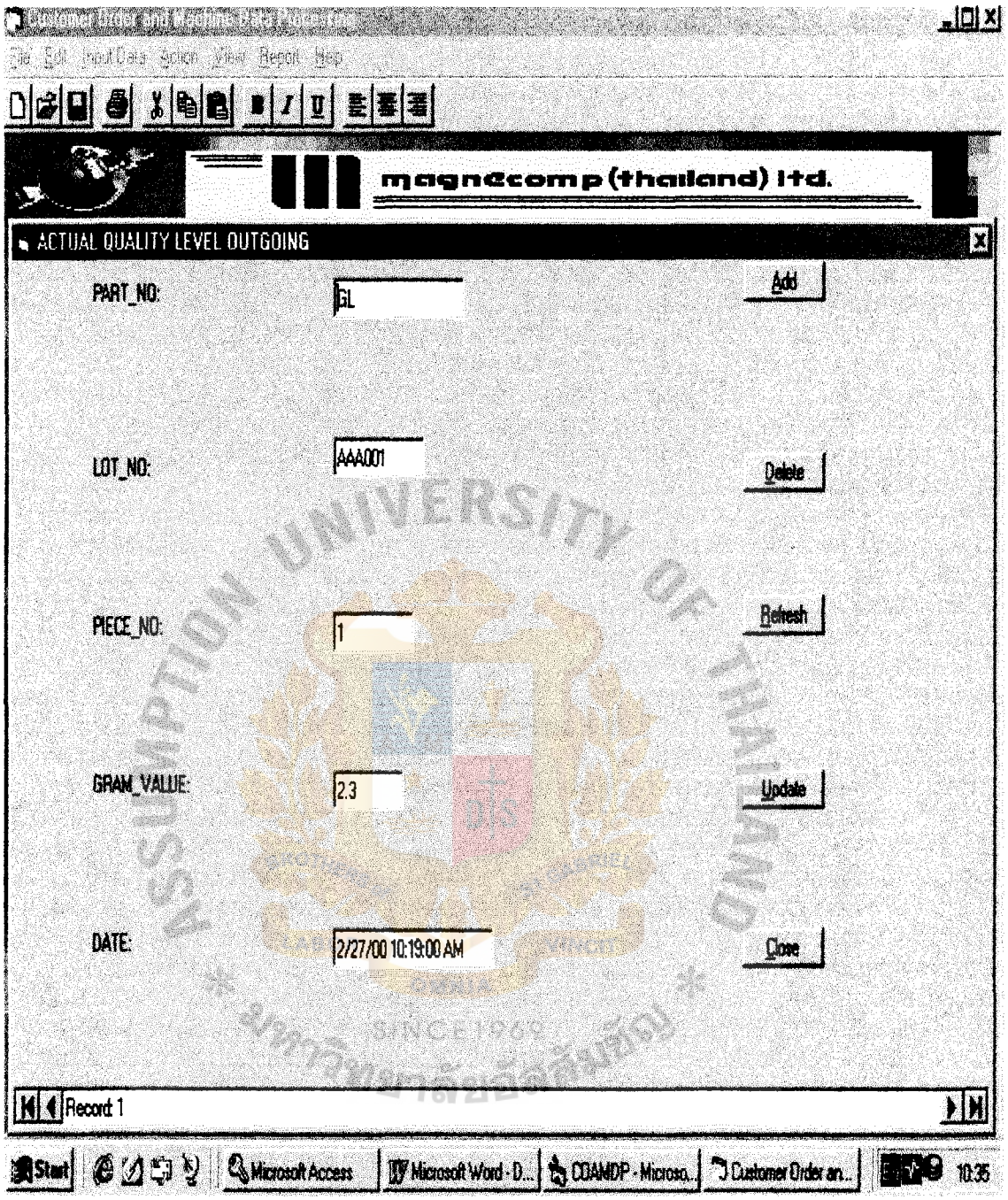


Figure H.10. Input Screen for AQL Outgoing.

APPENDIX I

OUTPUT SCREEN

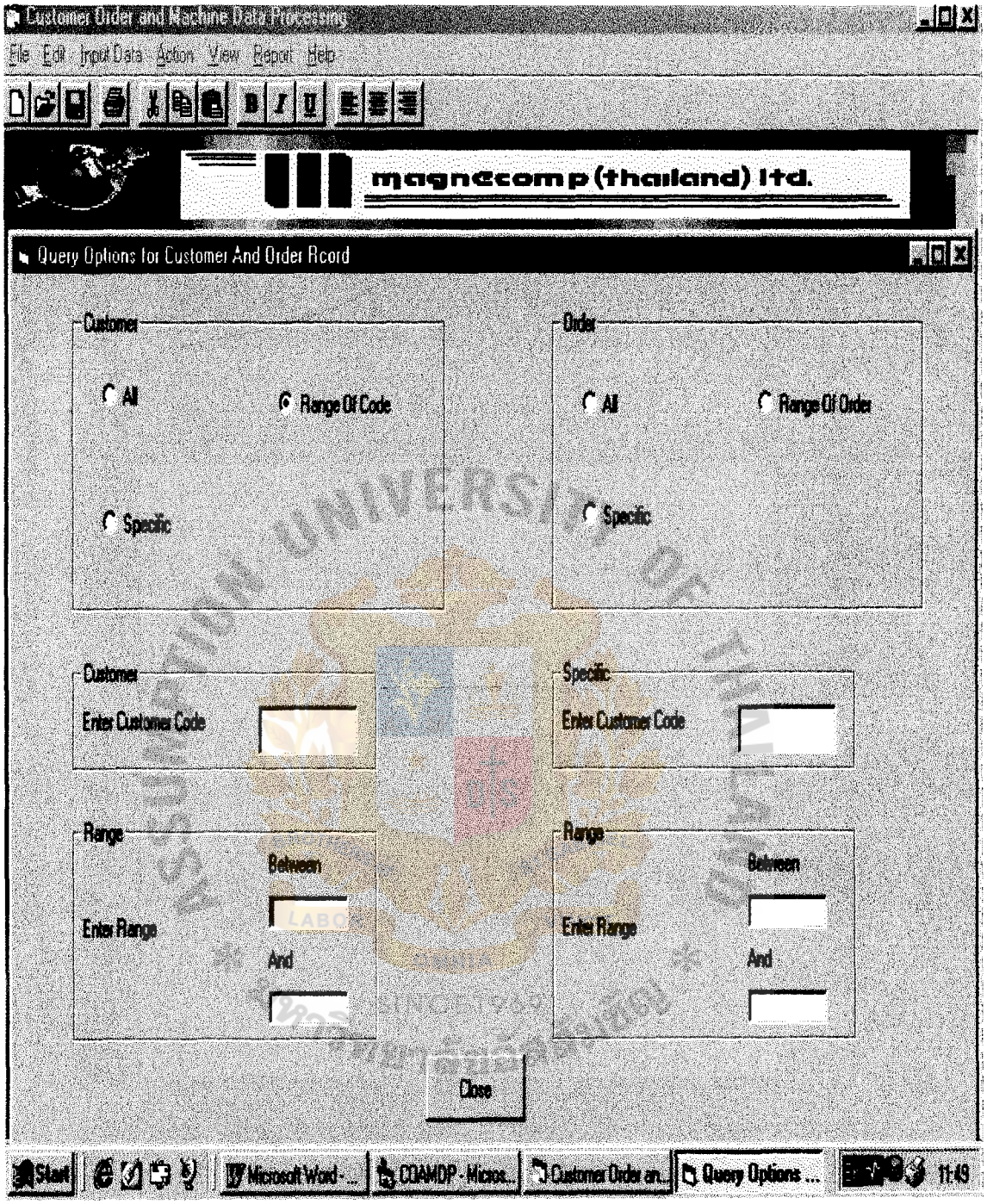


Figure I.1. Customer and Order Query Screen.

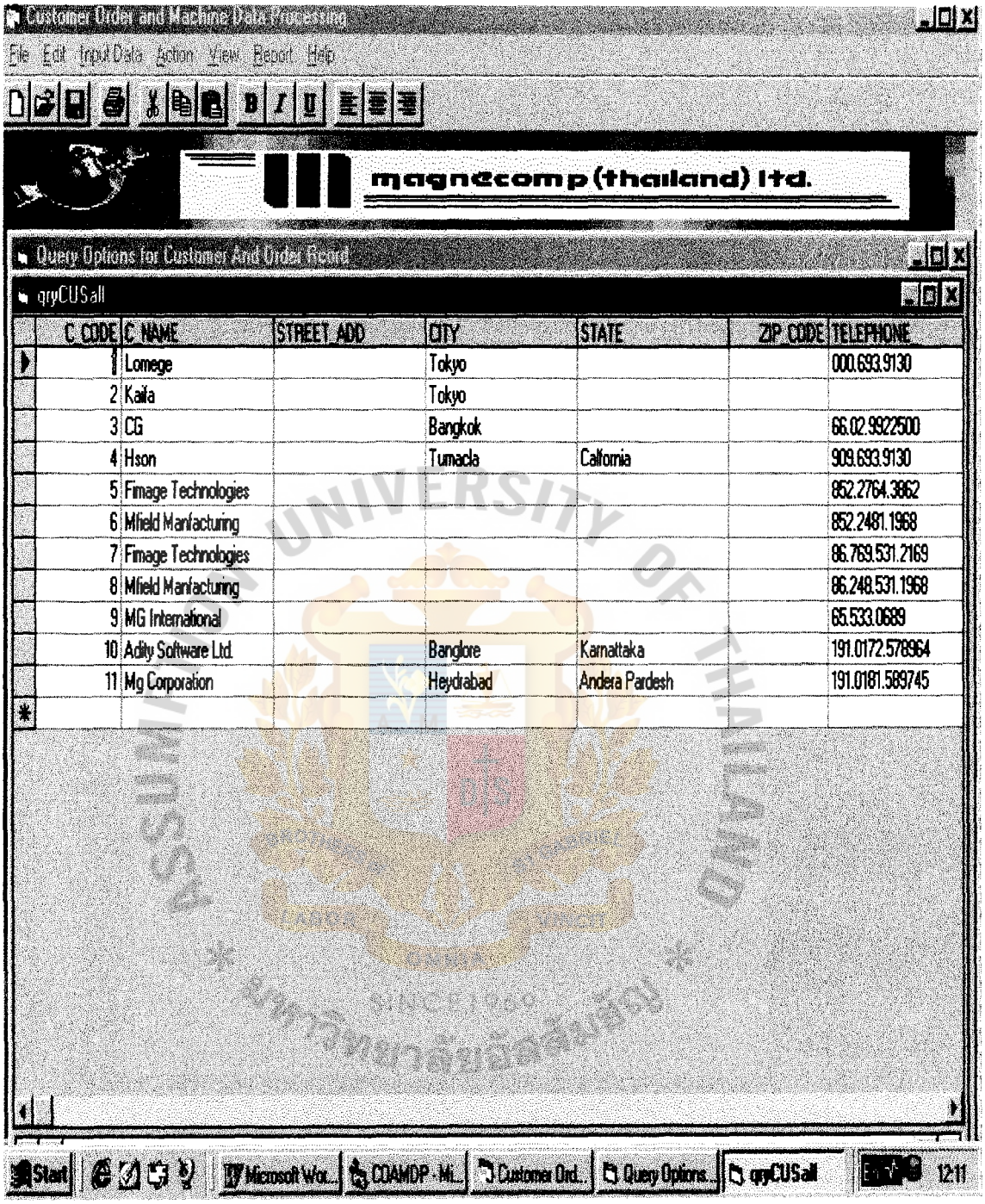


Figure I.2. All Customer Query.

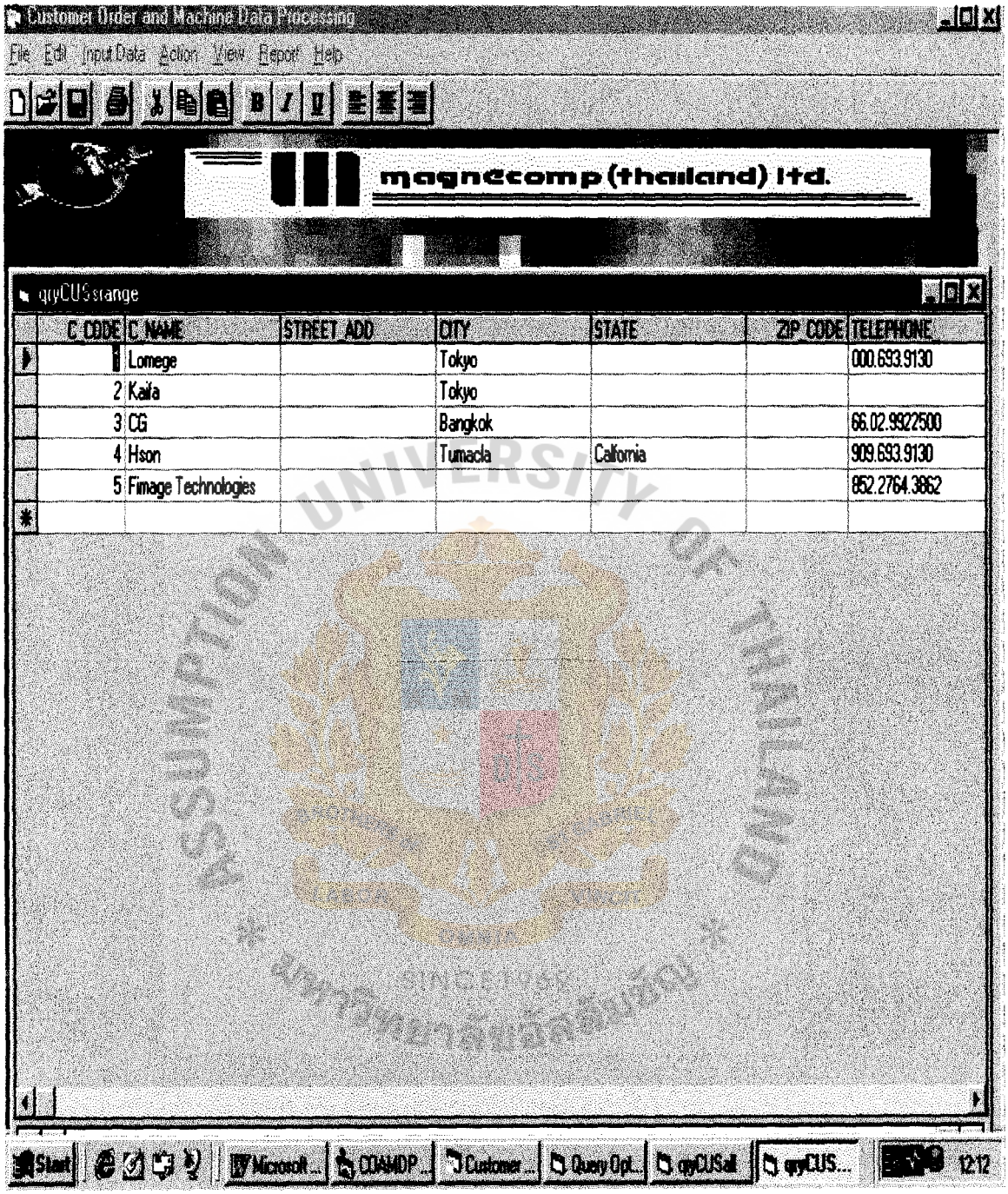


Figure I.3. Specific Customer Range Query.

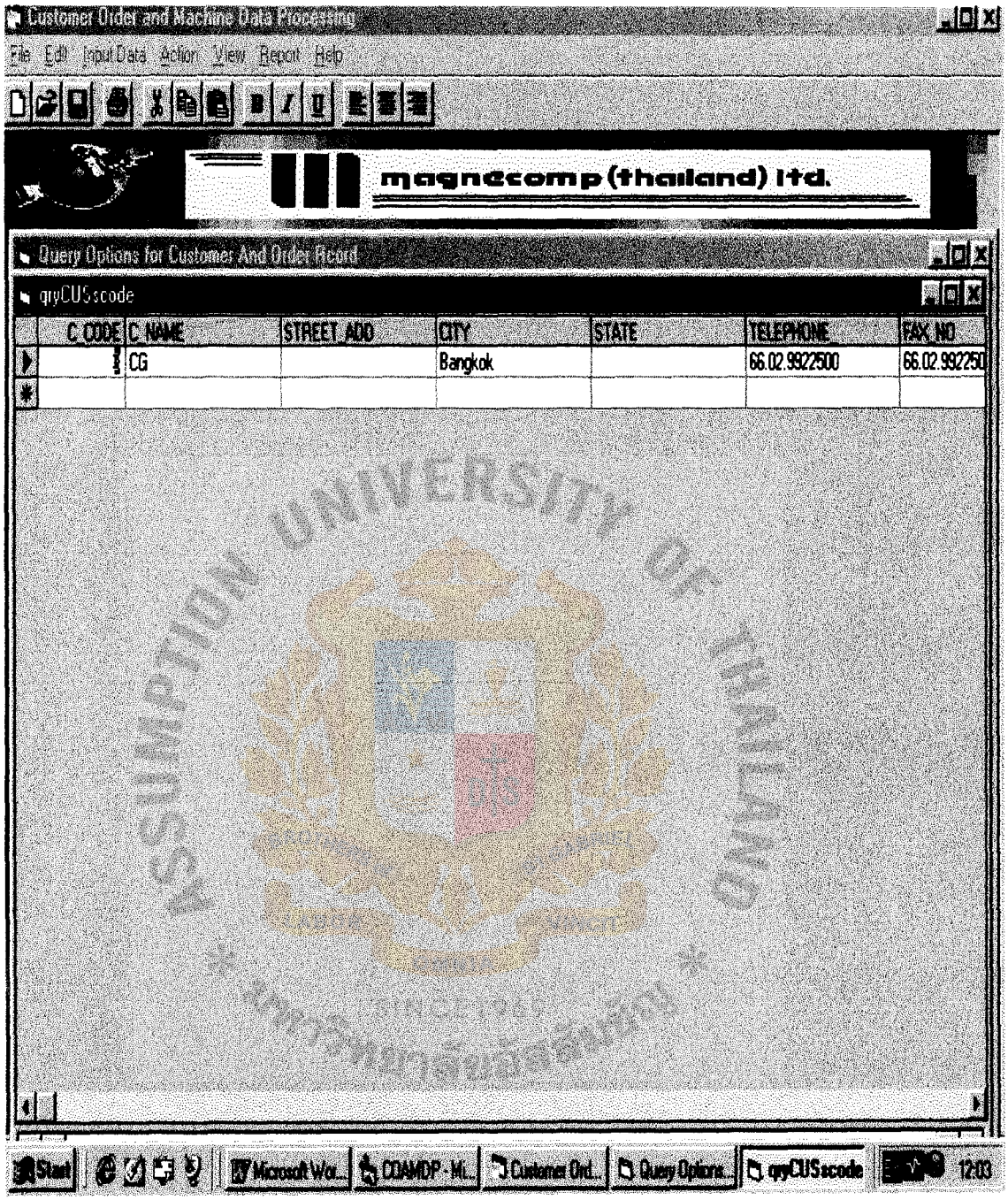
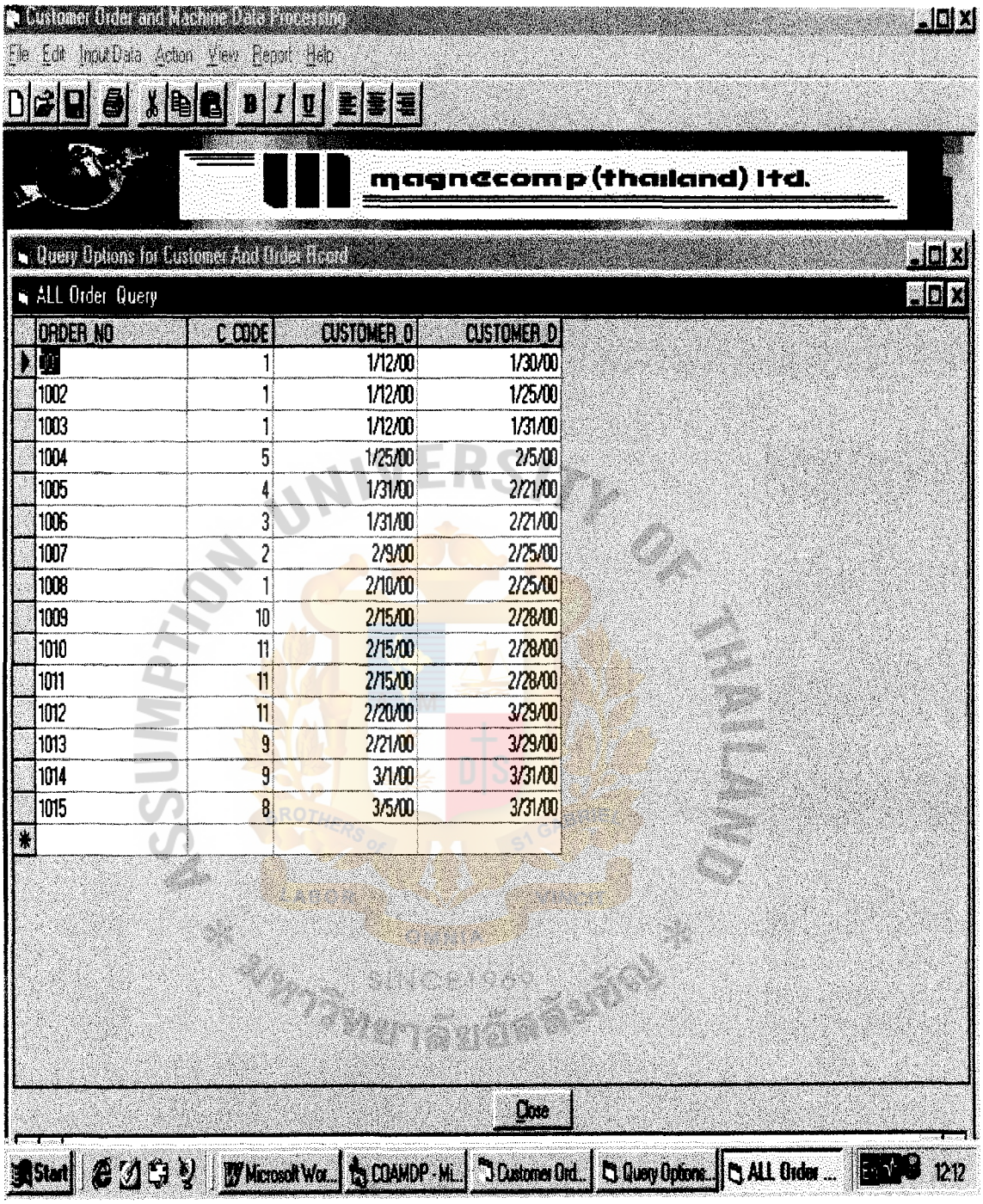


Figure I.4. Specific Customer Query.



ORDER_NO	C_CODE	CUSTOMER_O	CUSTOMER_D
1001	1	1/12/00	1/30/00
1002	1	1/12/00	1/25/00
1003	1	1/12/00	1/31/00
1004	5	1/25/00	2/5/00
1005	4	1/31/00	2/21/00
1006	3	1/31/00	2/21/00
1007	2	2/9/00	2/25/00
1008	1	2/10/00	2/25/00
1009	10	2/15/00	2/28/00
1010	11	2/15/00	2/28/00
1011	11	2/15/00	2/28/00
1012	11	2/20/00	3/29/00
1013	9	2/21/00	3/29/00
1014	9	3/1/00	3/31/00
1015	8	3/5/00	3/31/00

Figure I.5. All Customer Order Query.

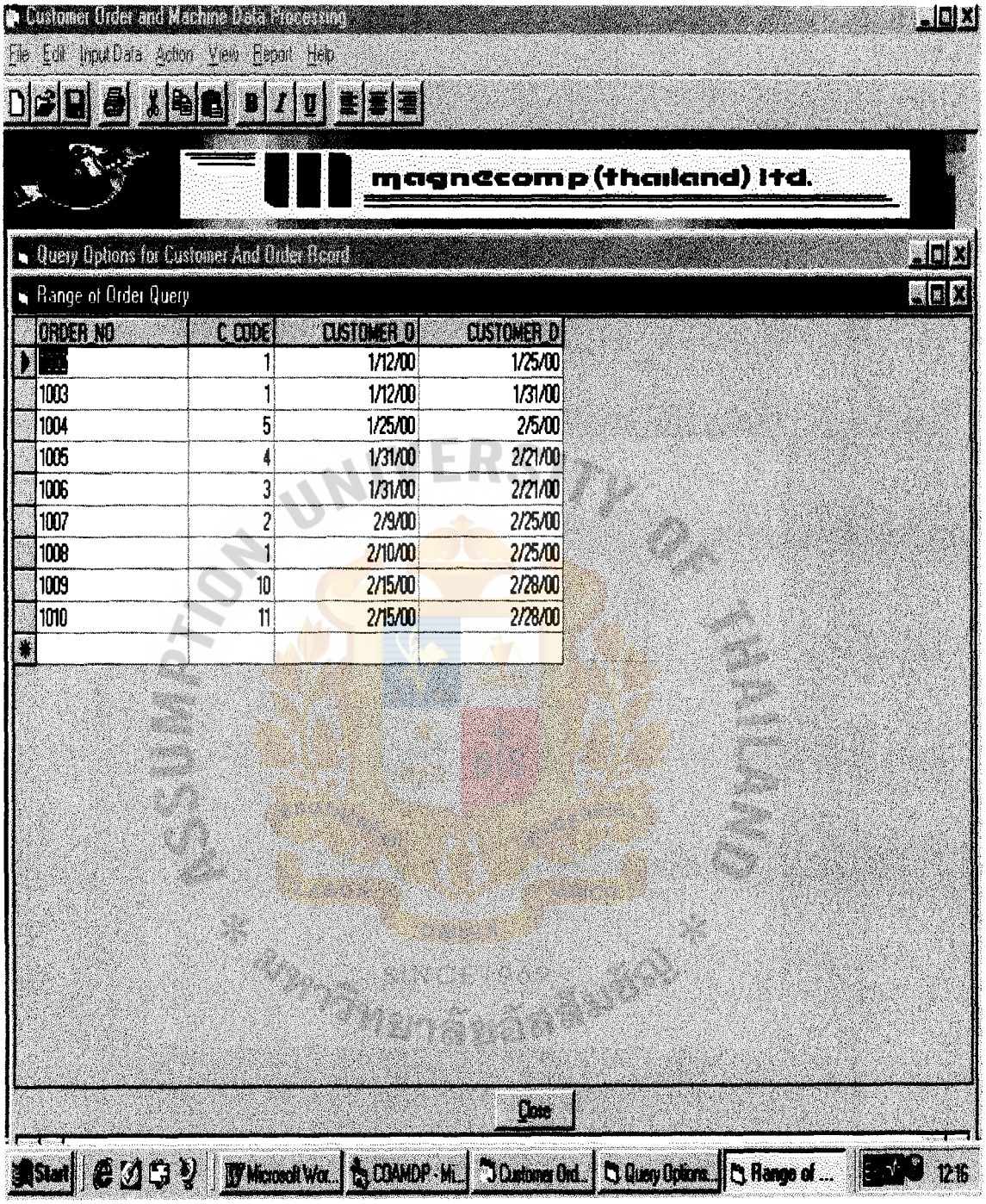


Figure I.6. Specific Customer Order Range Query.

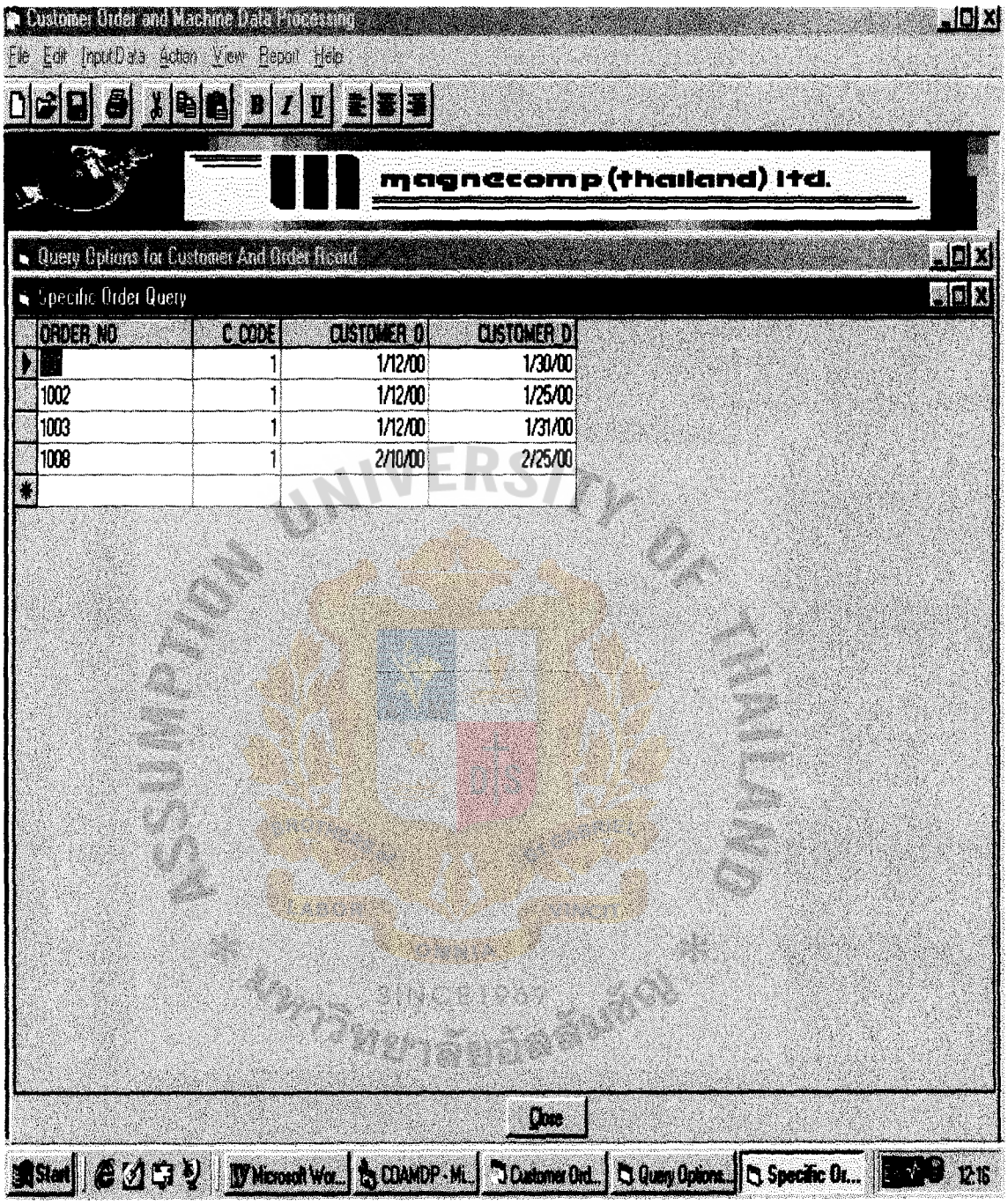


Figure I.7. Specific Customer Order Query.

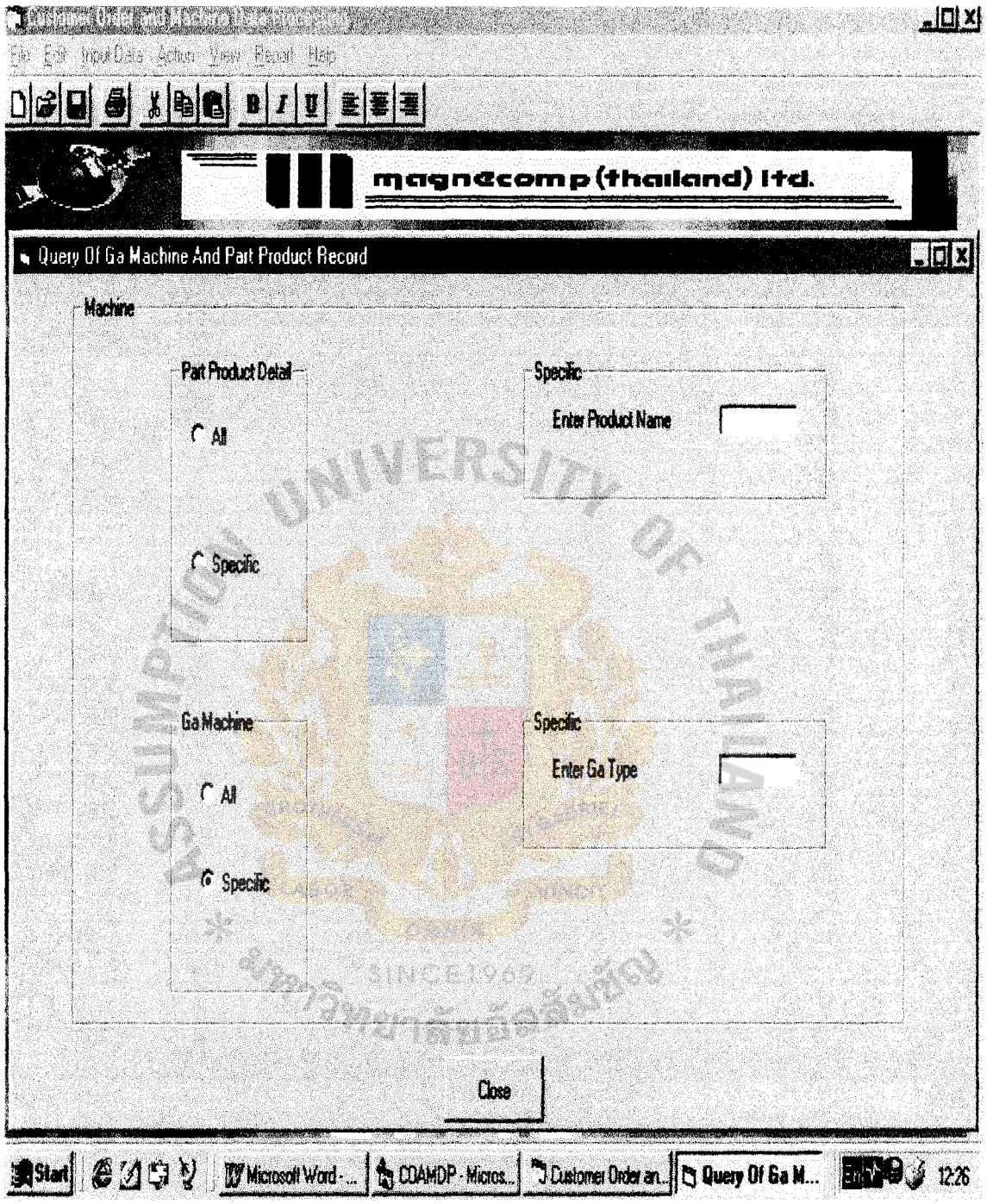


Figure I.8. GA Machine Part Product Query Screen.

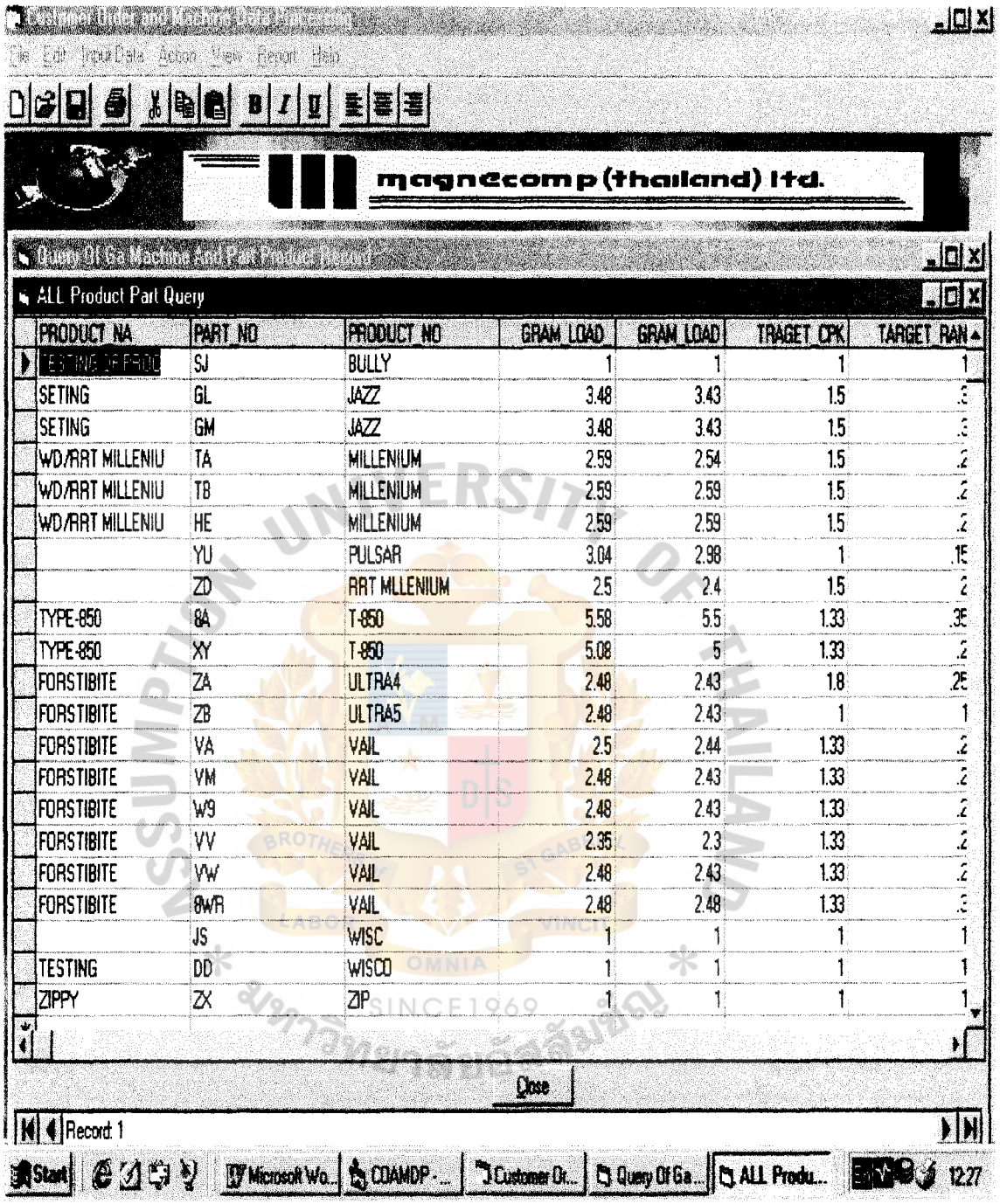


Figure I.9. All Product Part Query.

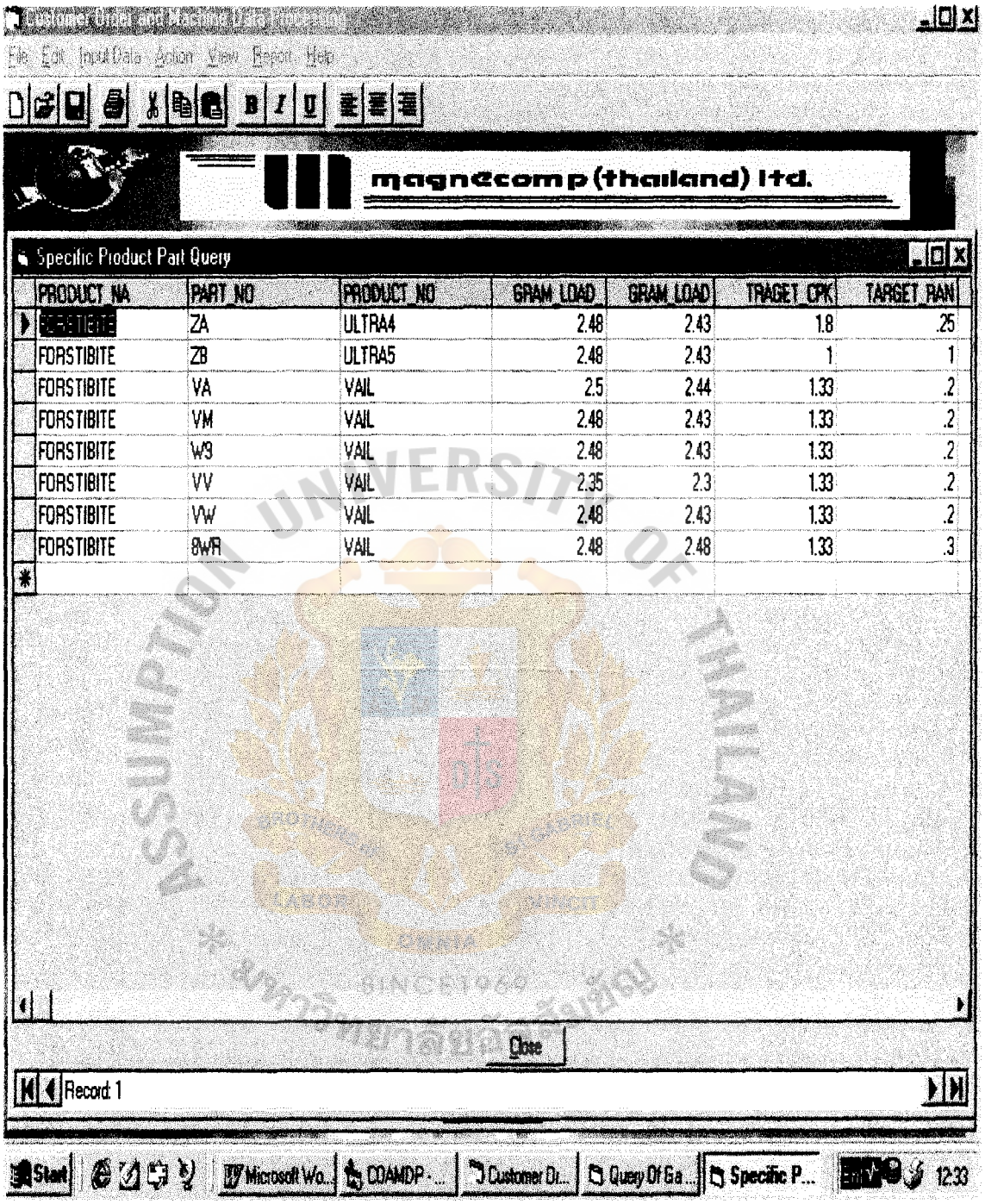


Figure I.10. Specific Product Part Range Query.

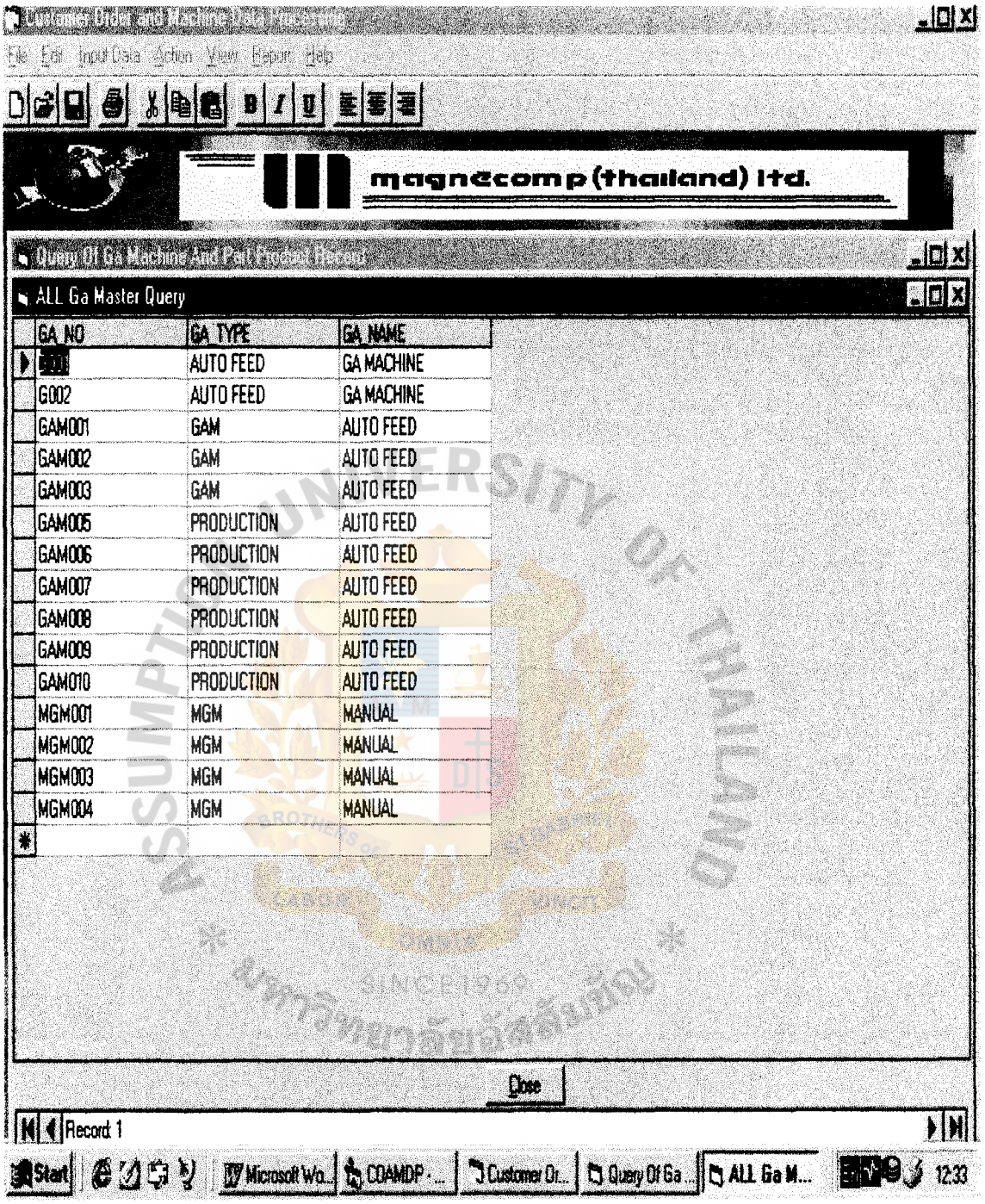


Figure I.11. Specific Product Part Query.

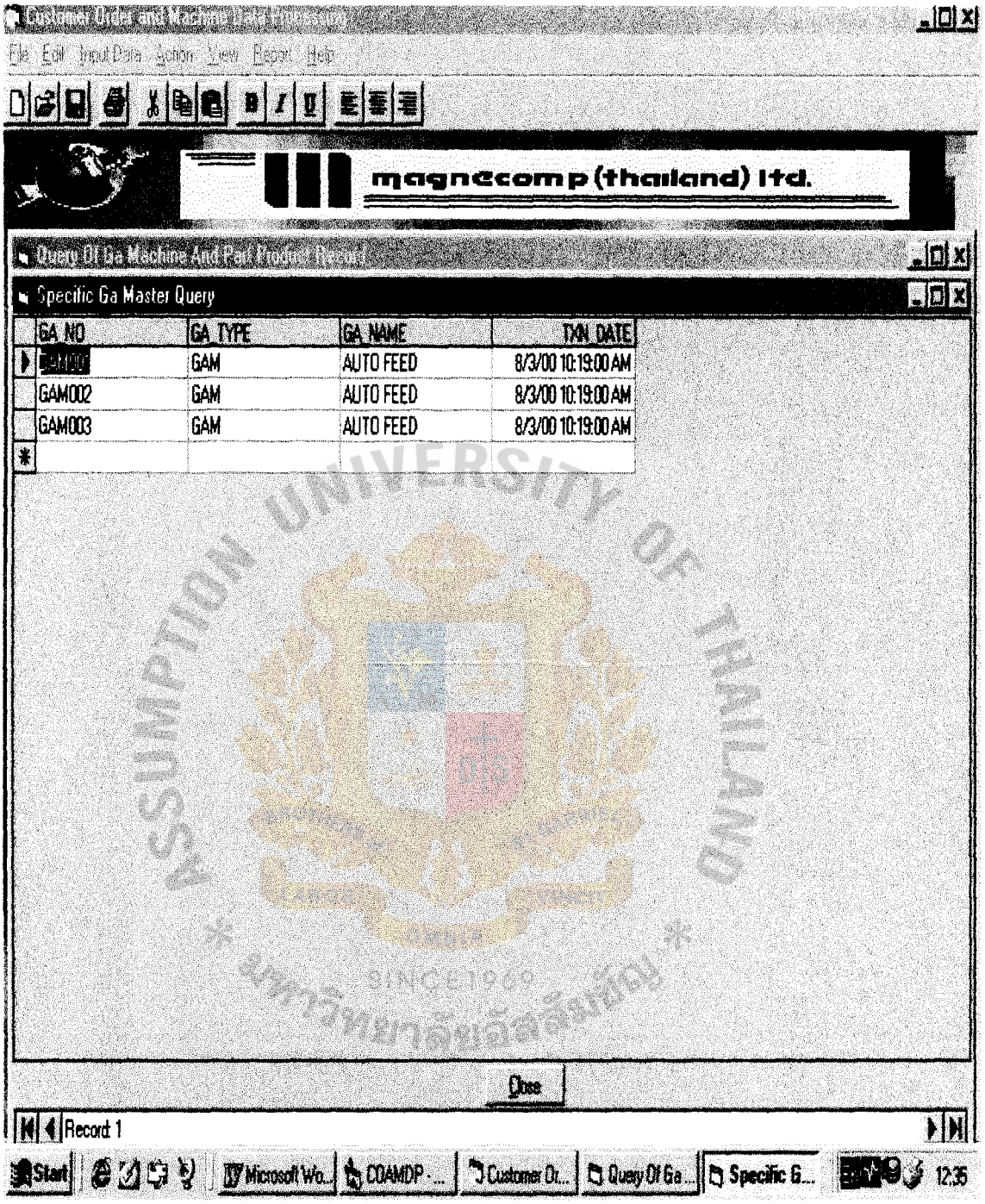


Figure I.12. Specific GA Master Query.

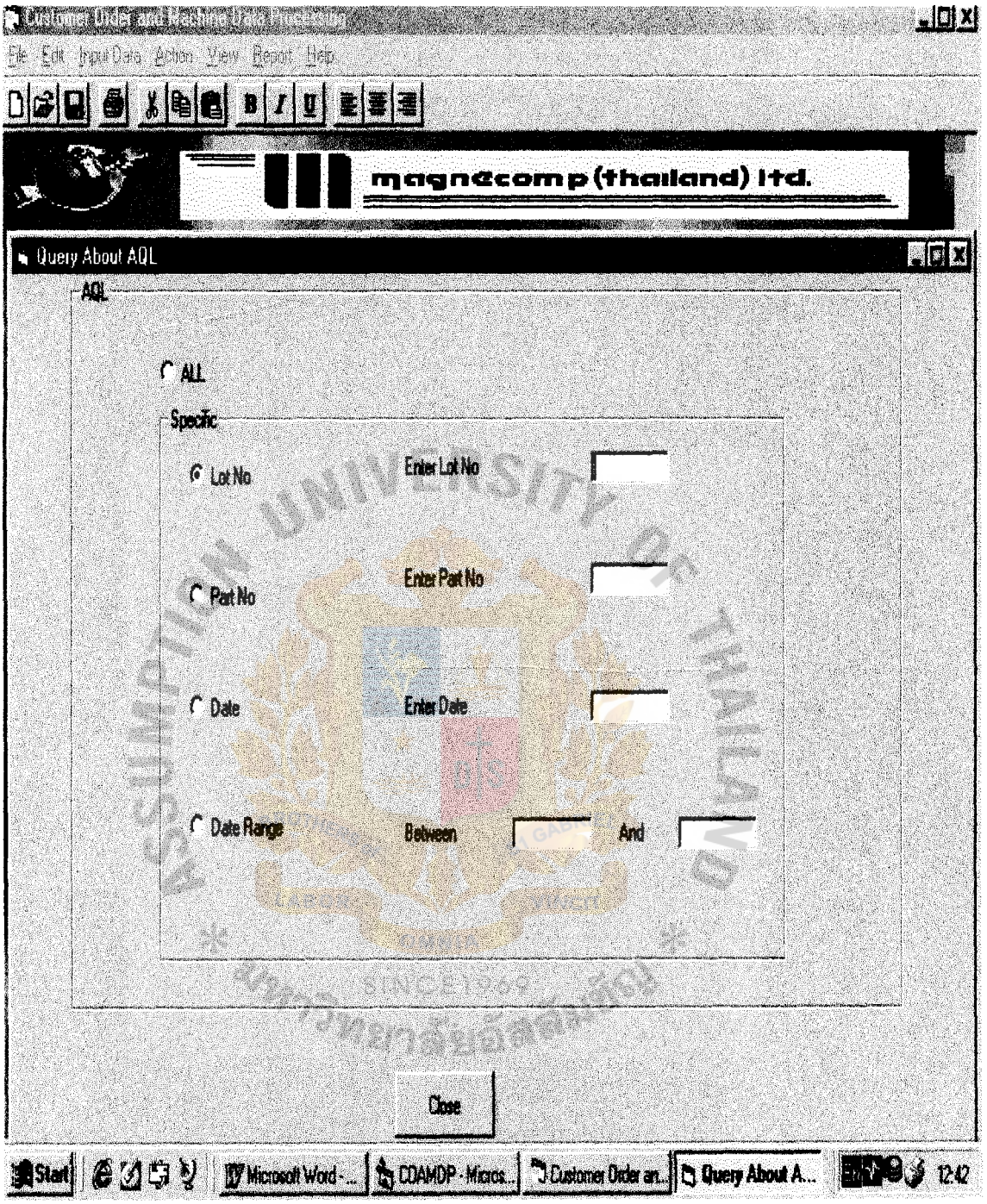
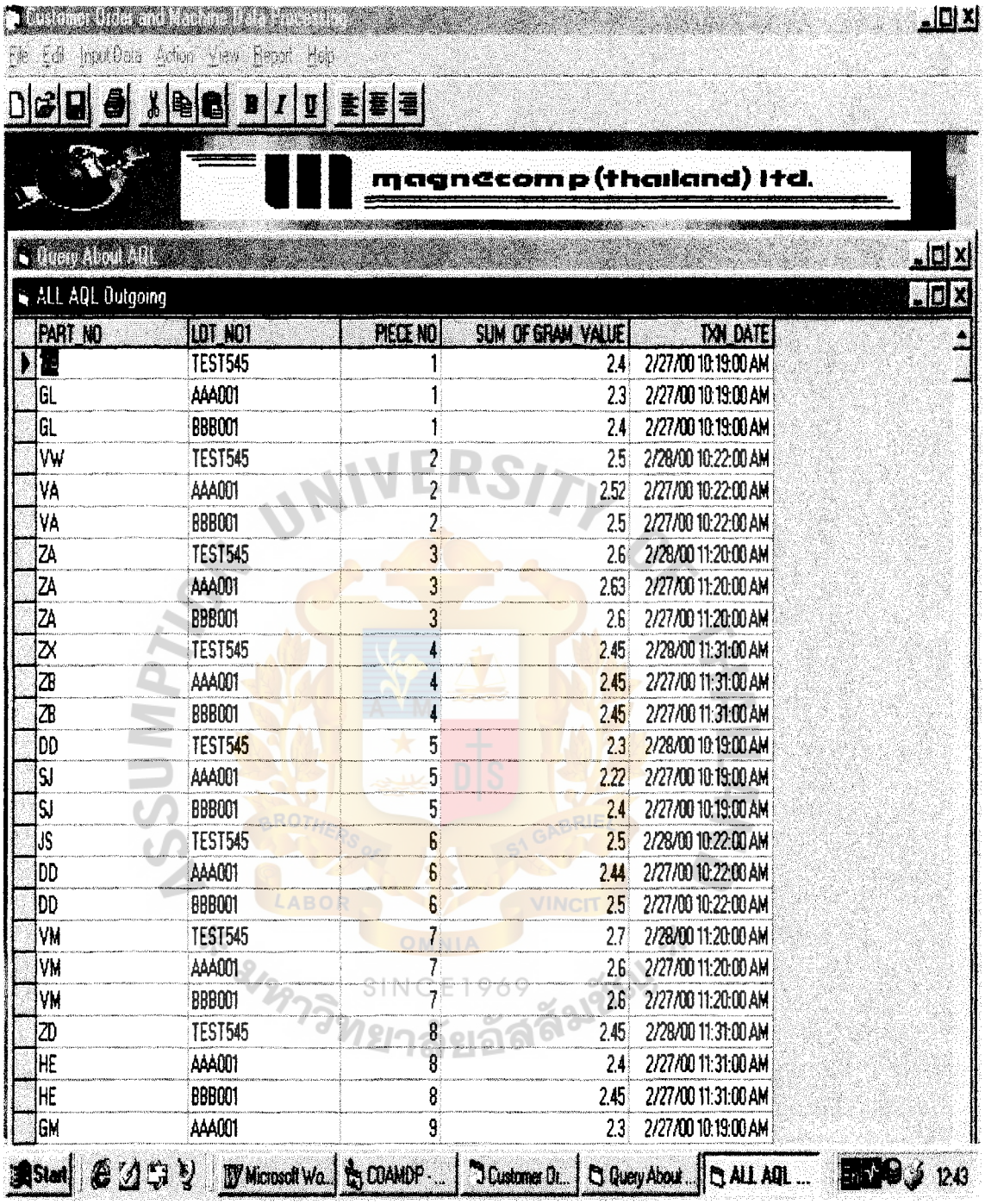


Figure I.13. Actual Quality Level Query Screen.



PART_NO	LOT_NO1	PIECE NO	SUM OF GRAM VALUE	TXN DATE
[redacted]	TEST545	1	2.4	2/27/00 10:19:00 AM
GL	AAA001	1	2.3	2/27/00 10:19:00 AM
GL	BBB001	1	2.4	2/27/00 10:19:00 AM
VW	TEST545	2	2.5	2/28/00 10:22:00 AM
VA	AAA001	2	2.52	2/27/00 10:22:00 AM
VA	BBB001	2	2.5	2/27/00 10:22:00 AM
ZA	TEST545	3	2.6	2/28/00 11:20:00 AM
ZA	AAA001	3	2.63	2/27/00 11:20:00 AM
ZA	BBB001	3	2.6	2/27/00 11:20:00 AM
ZX	TEST545	4	2.45	2/28/00 11:31:00 AM
ZB	AAA001	4	2.45	2/27/00 11:31:00 AM
ZB	BBB001	4	2.45	2/27/00 11:31:00 AM
DD	TEST545	5	2.3	2/28/00 10:19:00 AM
SJ	AAA001	5	2.22	2/27/00 10:19:00 AM
SJ	BBB001	5	2.4	2/27/00 10:19:00 AM
JS	TEST545	6	2.5	2/28/00 10:22:00 AM
DD	AAA001	6	2.44	2/27/00 10:22:00 AM
DD	BBB001	6	2.5	2/27/00 10:22:00 AM
VM	TEST545	7	2.7	2/28/00 11:20:00 AM
VM	AAA001	7	2.6	2/27/00 11:20:00 AM
VM	BBB001	7	2.6	2/27/00 11:20:00 AM
ZD	TEST545	8	2.45	2/28/00 11:31:00 AM
HE	AAA001	8	2.4	2/27/00 11:31:00 AM
HE	BBB001	8	2.45	2/27/00 11:31:00 AM
GM	AAA001	9	2.3	2/27/00 10:19:00 AM

Figure I.14. All AQL Query.

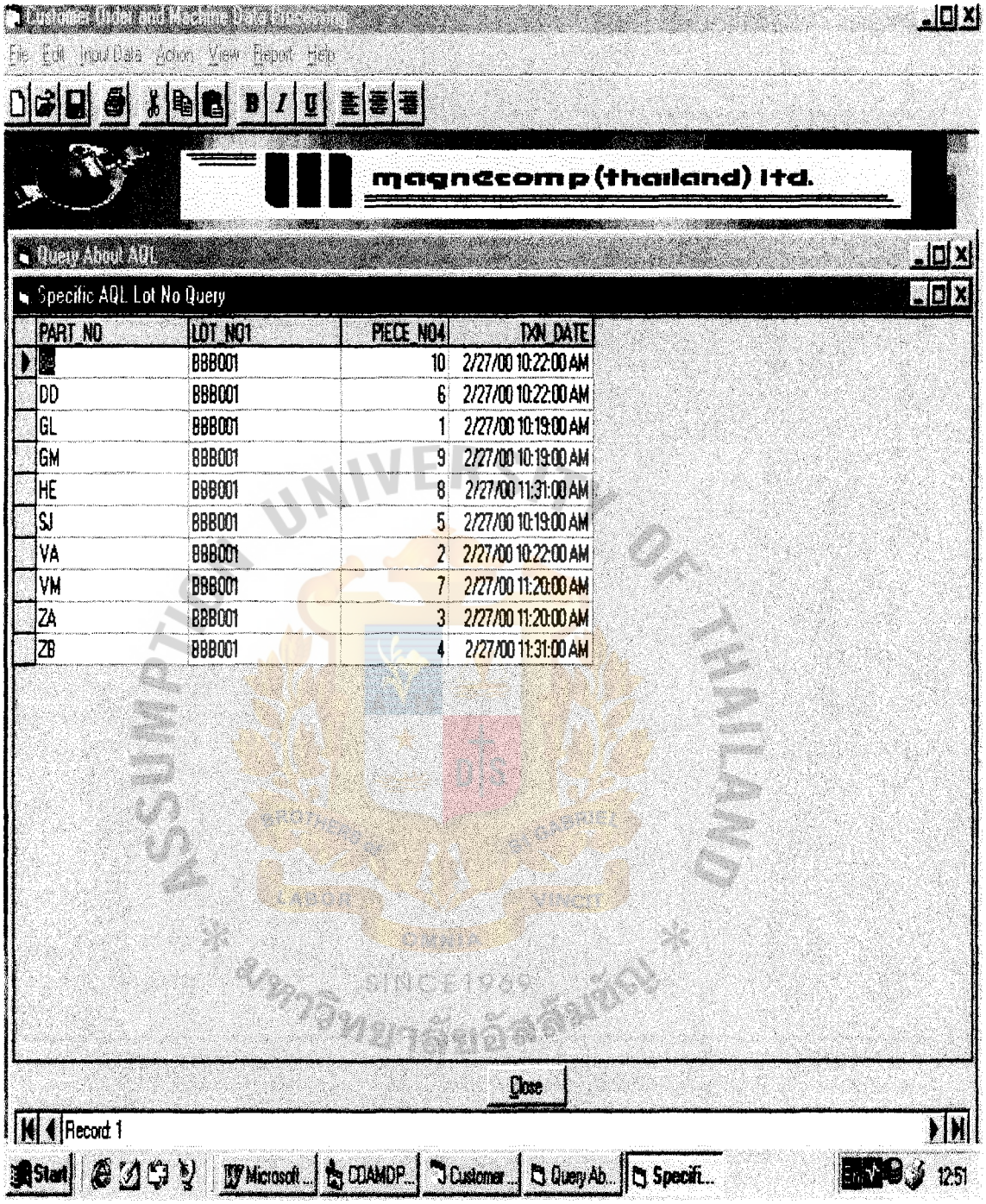


Figure I.15. Specific Lot AQL Query.

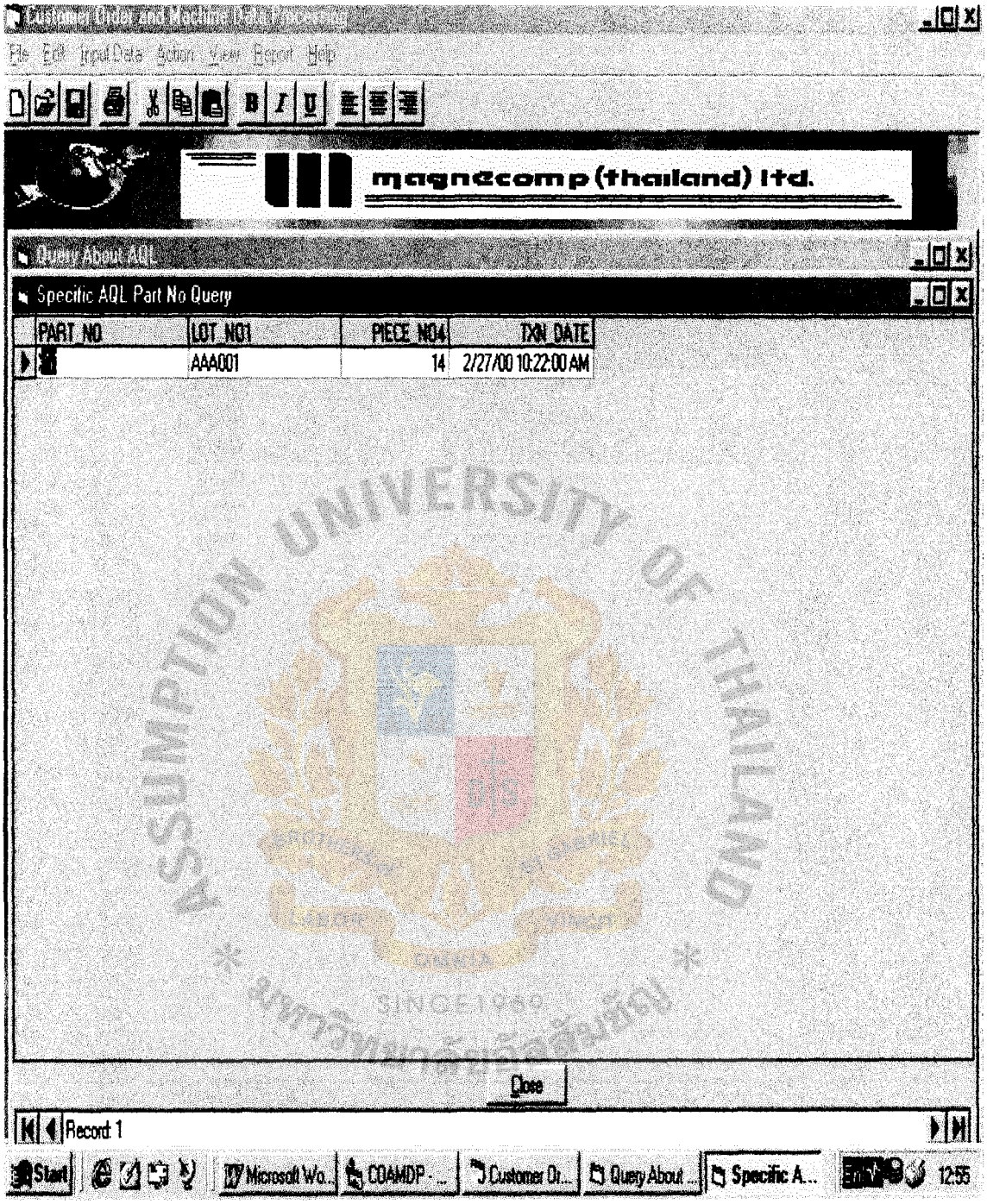


Figure I.16. Specific Part AQL Query.

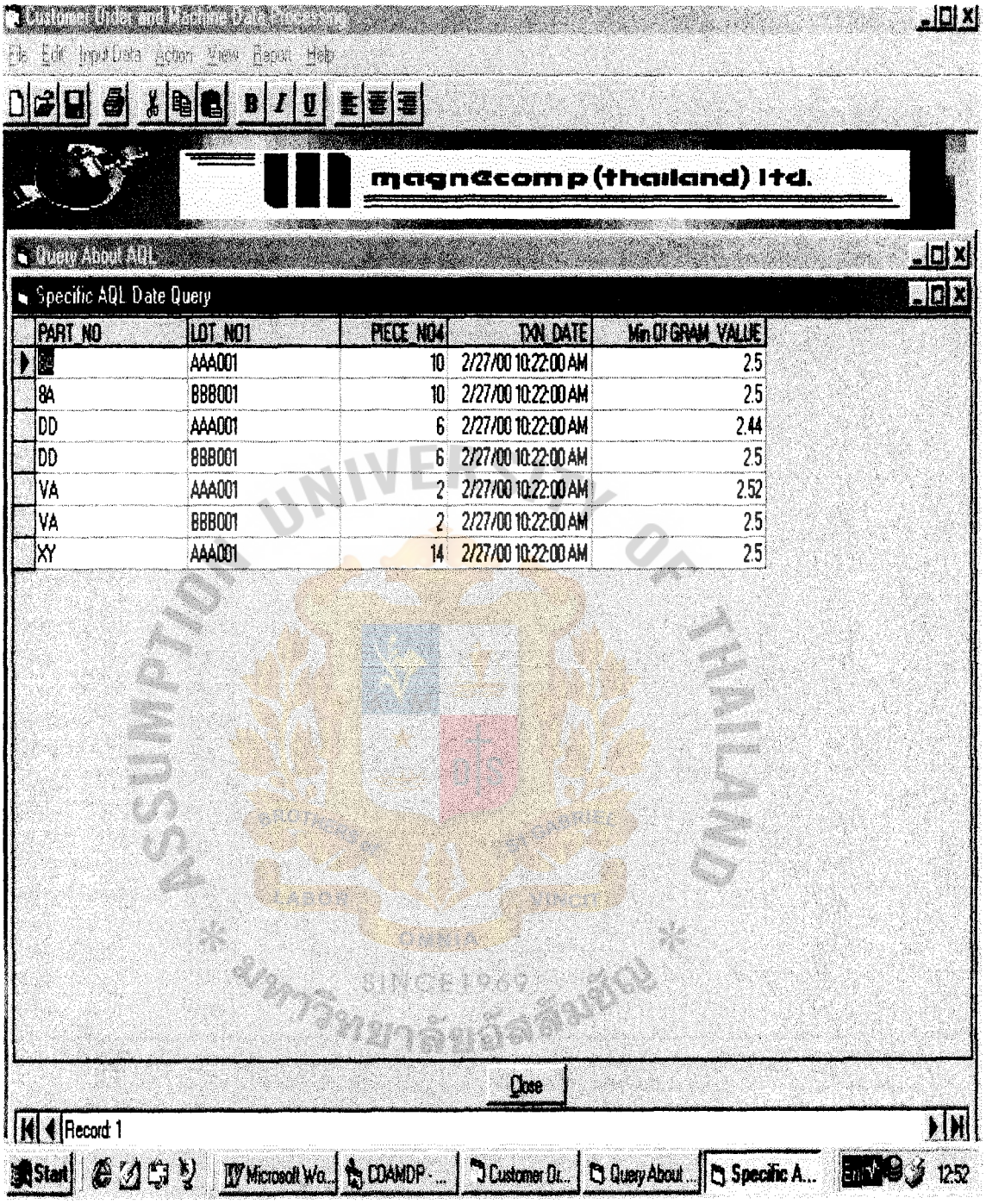


Figure I.17. Specific Date AQL Query.

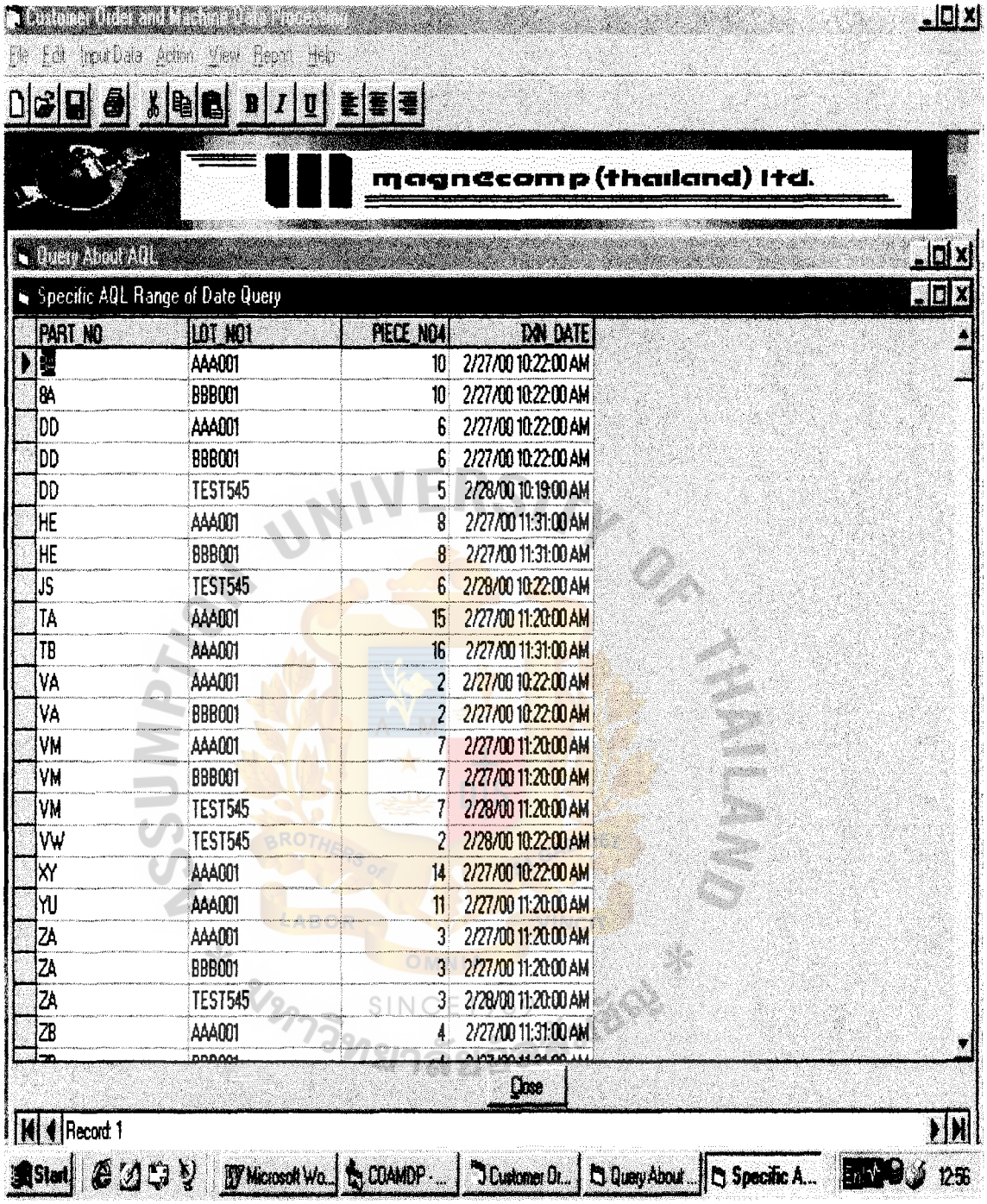


Figure I.18. Specific Date Range AQL Query.

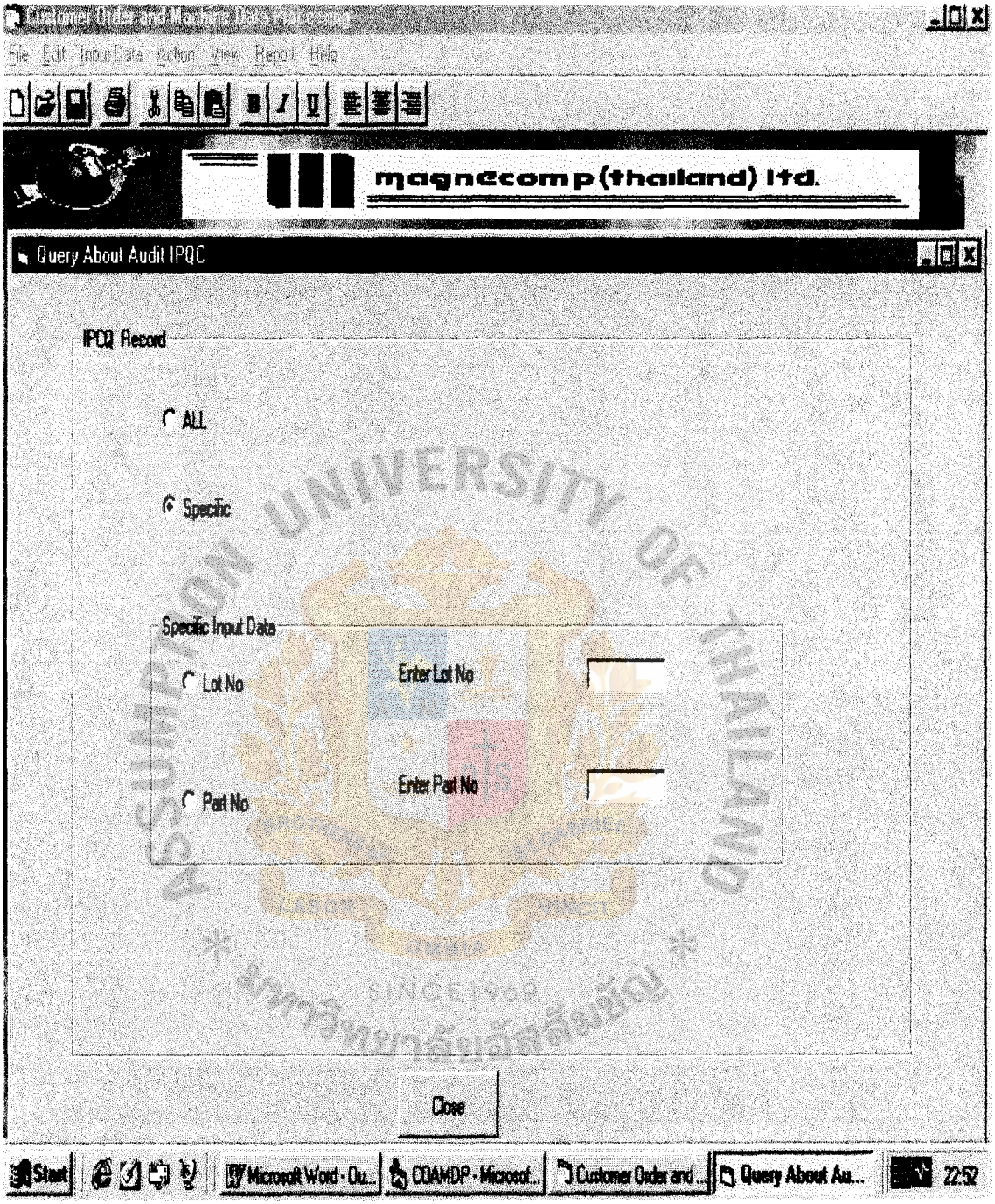


Figure I.19. IPQC Query Screen.

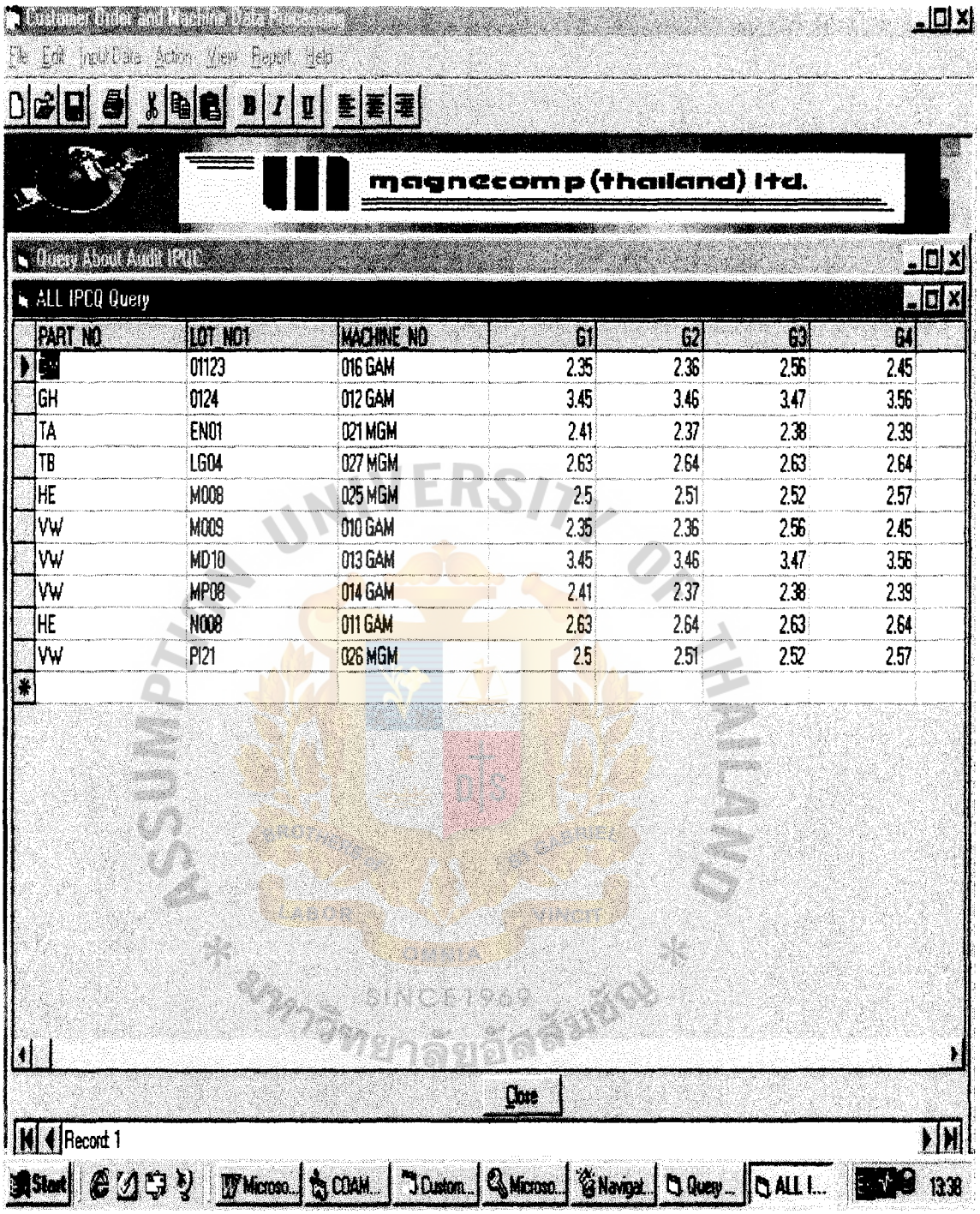


Figure I.20. All IPQC Query.

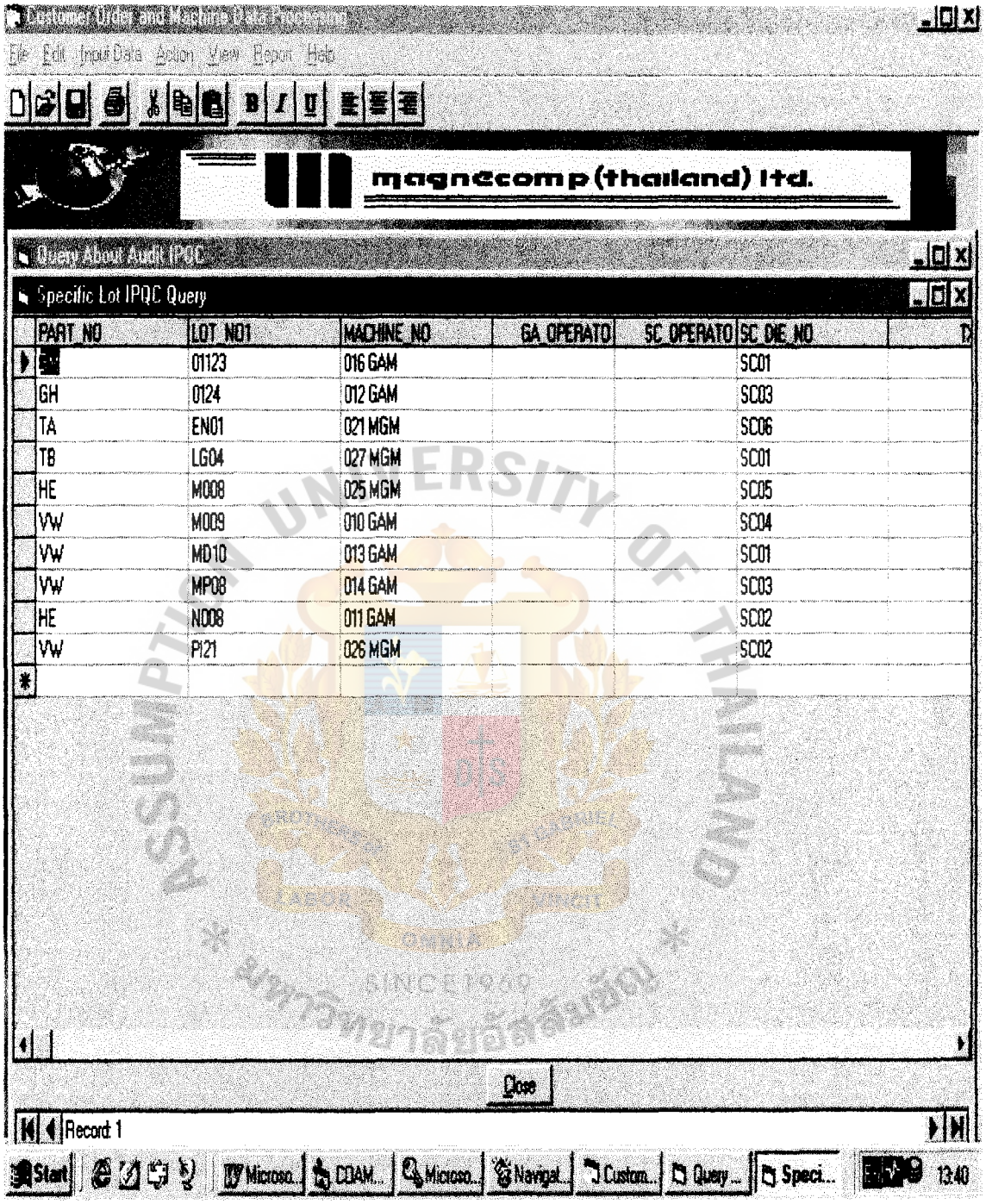


Figure I.21. Specific Lot IPQC Query.

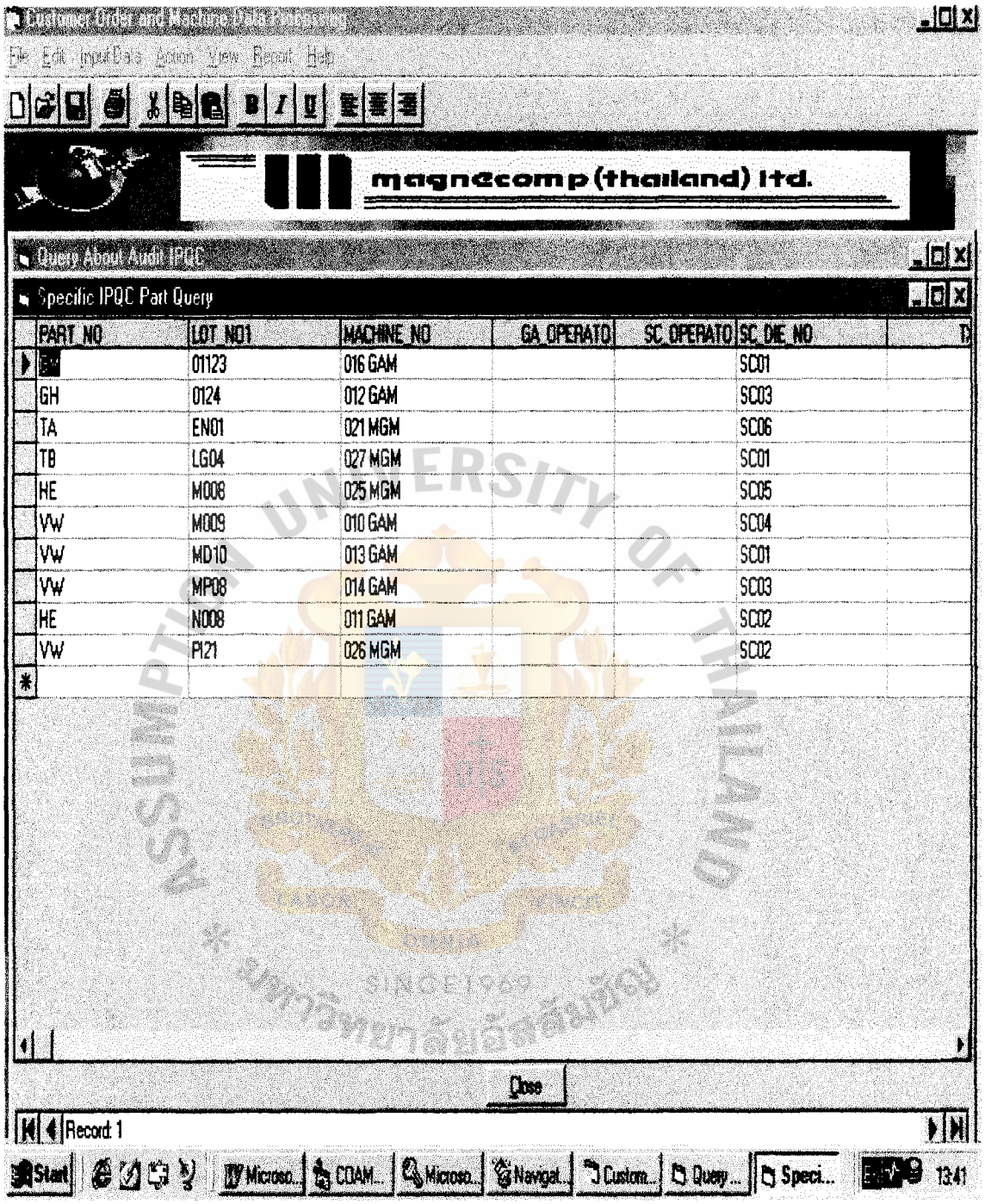


Figure I.22. Specific Part IPQC Query.

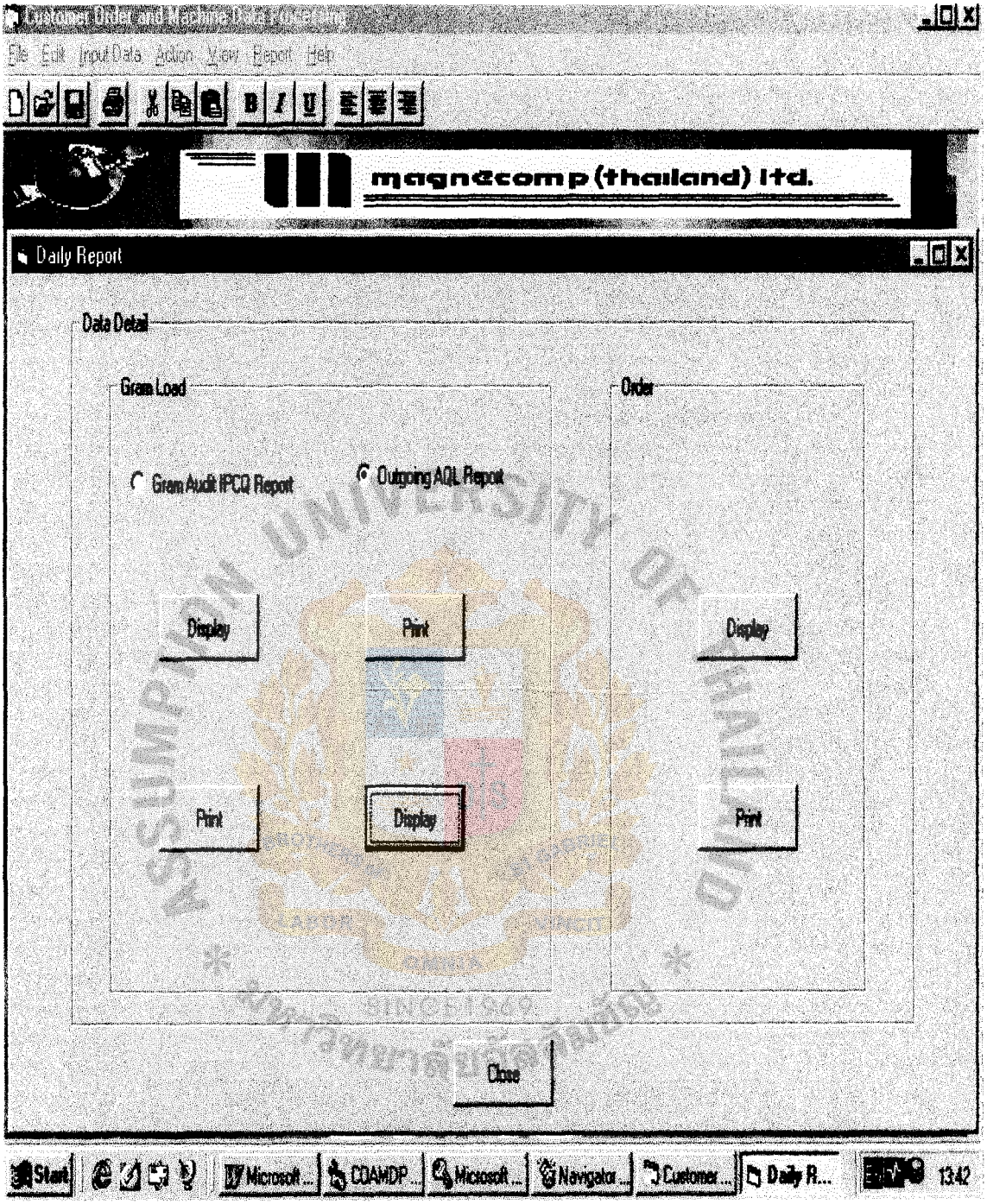


Figure I.23. Daily Report Screen.

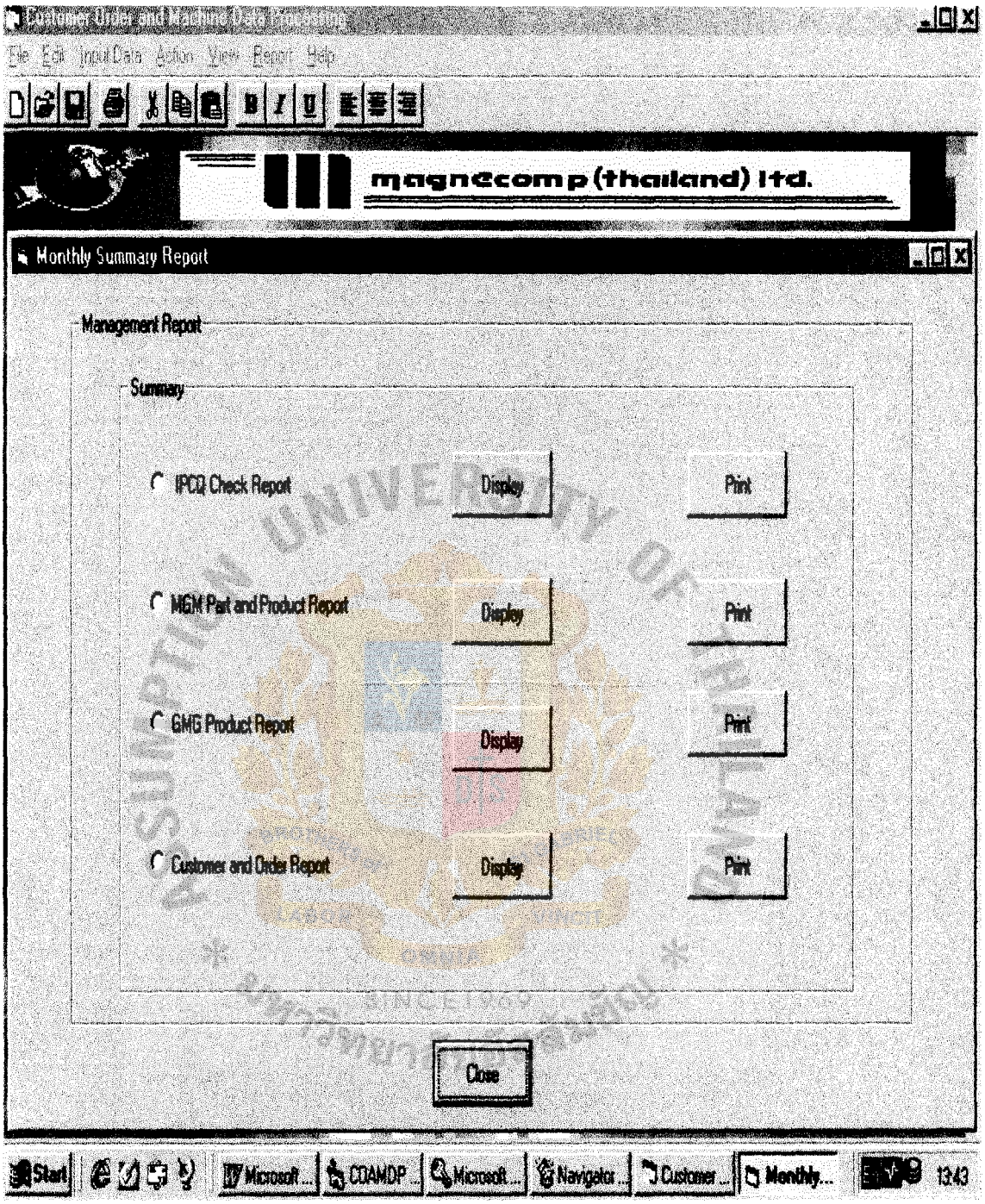


Figure I.24. Monthly Report Screen.

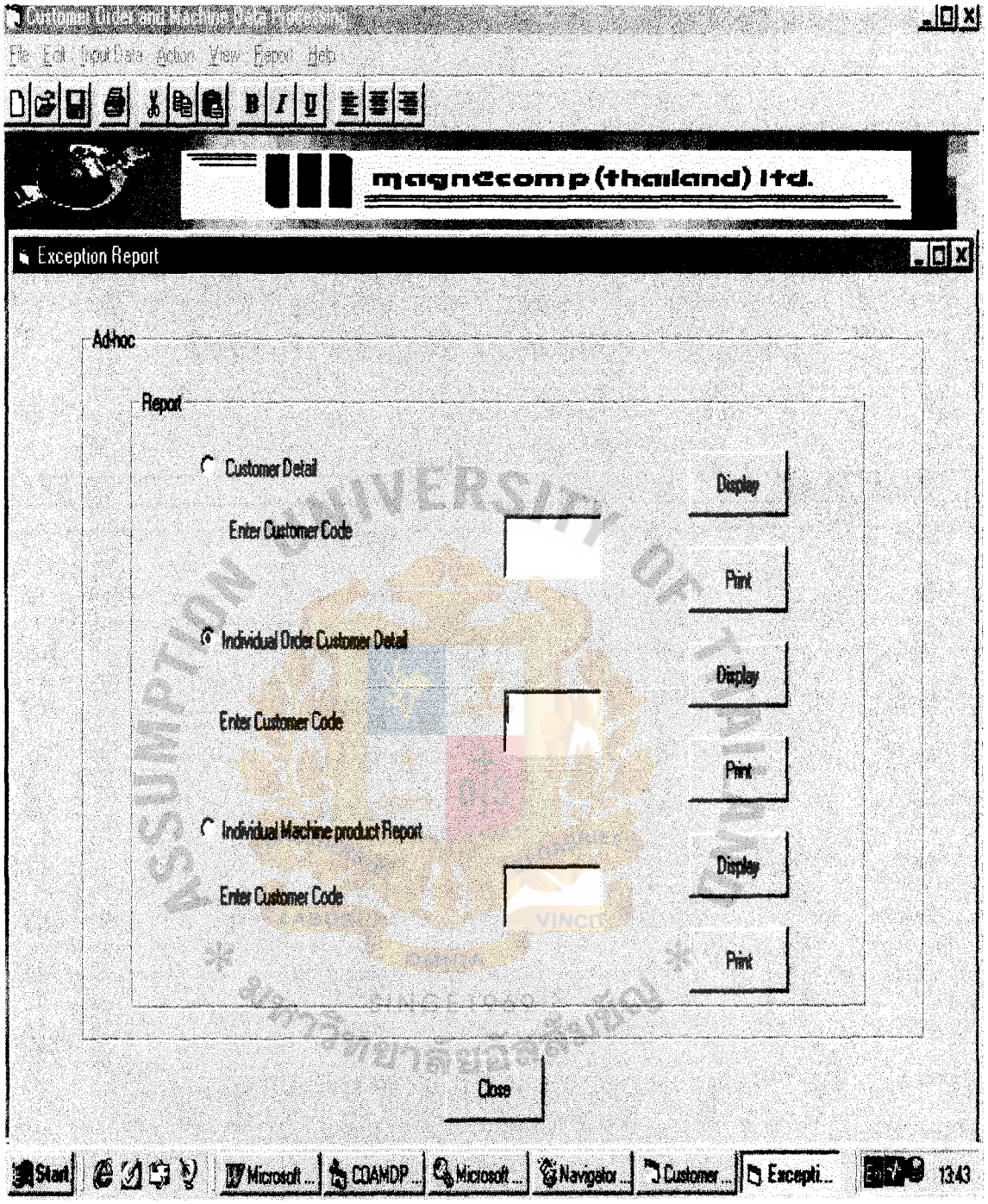


Figure I.25. Exception Report Screen.

Daily Report

magnecomp (thailand) ltd.

Daily Gram Load Data (AQL Outgoing

8/8/00

PART NO	LOT NO	PIECE NO	GRAM VALUE
GL	AAA001	1	2.30
GL	BBB001	1	2.40
GM	AAA001	9	2.30
GM	BBB001	9	2.40
SJ	AAA001	5	2.22
SJ	BBB001	5	2.40
VA	TEST545	1	2.40
ZD	AAA001	13	2.40
8A	AAA001	10	2.50
8A	BBB001	10	2.50
DD	AAA001	6	2.44
DD	BBB001	6	2.50
VA	BBB001	2	2.50
VA	AAA001	2	2.52
XY	AAA001	14	2.50
TA	AAA001	15	2.70
VM	BBB001	7	2.60

Figure I.26. Daily Gram Load Report.

Daily Report

magnecomp (thailand) ltd.

Daily Gram Load Data Detail (Audit IPCQ)

8/8/00

PART_NO	LOT_NO	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14	G15	DATE
GH	0124	3.543.463.47		3.563.213.45			3.46		3.483.22		3.47	3.57		3.613.45		3.22	2.31	2/3/00
GM	01123	2.352.362.56		2.452.502.60			2.45		2.452.54		2.47	2.47		2.562.78		2.63	2.31	1/3/00
HE	N008	2.632.642.63		2.642.652.66			2.65		2.612.67		2.68	2.69		2.662.64		2.65	2.64	9/3/00
TA	M008	2.502.512.52		2.572.562.55			2.54		2.592.51		2.57	2.54		2.592.49		2.54	2.56	5/3/00
TB	EN01	2.412.372.38		2.392.372.37			2.38		2.332.45		2.63	2.33		2.432.44		2.45	2.46	3/3/00
VW	LG04	2.632.642.63		2.642.652.66			2.65		2.612.67		2.68	2.69		2.662.64		2.65	2.64	4/3/00
VW	PI21	2.502.512.52		2.572.562.55			2.54		2.592.51		2.57	2.54		2.592.49		2.54	2.56	10/3/00
VW	M009	2.352.362.56		2.452.502.60			2.45		2.452.54		2.47	2.47		2.562.78		2.63	2.31	6/3/00
VW	MD10	3.453.463.47		3.563.213.45			3.46		2.483.22		3.47	3.57		3.613.45		3.22	2.31	7/3/00
VW	MP08	2.412.372.38		2.392.372.37			2.38		2.332.45		2.63	2.33		2.432.44		2.45	2.46	8/3/00

Figure I.27. Daily Gram Load Report.

Daily Report

magnecomp (thailand) ltd.

Daily Order Report

8/8/00

ORDER_NO	NO_CODE	CUSTOMER_O	CUSTOMER_D	ITEM_NO	PRODUCT_NO	QUANTITY_P
1006	3	31/1/00	21/2/00	4	BULLY	1,000
1006	3	31/1/00	21/2/00	3	ZIP	500
1006	3	31/1/00	21/2/00	2	WISCO	500
1006	3	31/1/00	21/2/00	1	VAIL	4,000
1005	4	31/1/00	21/2/00	4	NET	100
1005	4	31/1/00	21/2/00	3	MILLENIUM	500
1005	4	31/1/00	21/2/00	2	JAZZ	2,000
1005	4	31/1/00	21/2/00	1	BULLY	500

Figure I.28. Daily Order Report.

Monthly Report

magnecomp (thailand) ltd.

Summary Report Customer and orde

8/8/00

C_CODE	C_NAME	Country	CITY	TELEPHONE	CREDIT	ORDER_NO	CUST_O_D
1	Lomege	Japan	Tokyo	000.693.9130		1008	25/2/00
1	Lomege	Japan	Tokyo	000.693.9130		1003	31/1/00
1	Lomege	Japan	Tokyo	000.693.9130		1002	25/1/00
1	Lomege	Japan	Tokyo	000.693.9130		001	30/1/00
Total	4.00						
2	Kaifa	Japan	Tokyo			1007	25/2/00
Total	1.00						
3	CG	Thailand	Bangkok	66.02.9922500		1006	21/2/00
Total	1.00						
4	Hson	U.S.A	Tumacla	909.693.9130		1005	21/2/00
Total	1.00						
5	Fimage Technol	Hong Kon		852.2764.3862		1004	5/2/00
Total	1.00						
8	Mfield Manfactu	Chnia		86.248.531.19		1015	31/3/00
Total	1.00						
9	MG Internationa	Singapore		65.533.0689		1014	31/3/00
9	MG Internationa	Singapore		65.533.0689		1013	29/3/00
Total	2.00						

Figure I.29. Customer and Order Summary Report.

Monthly Summary Report

magnecomp (thailand) ltd.

Summary of MGM Part Product

8/8/00

PRODUCT_NO	PART_NO	GRAM_LOAD	RAGET_CPK	ARGER_RANE	ARGET_MEAN
BULLY	SJ	1.00	1.00	1.00	2.60
JAZZ	GL	3.48	1.50	.30	3.48
JAZZ	GM	3.48	1.50	.30	3.50
MILLENIUM	TA	2.59	1.50	.20	2.63
MILLENIUM	TB	2.59	1.50	.20	2.64
MILLENIUM	HE	2.59	1.50	.20	2.69
PULSAR	YU	3.04	1.00	.15	2.60
RRT MILLEN	ZD	2.50	1.50	2.00	2.54
T-850	8A	5.58	1.33	.35	5.20
T-850	XY	5.08	1.33	.20	2.54
ULTRA4	ZA	2.48	1.80	.25	2.63
ULTRA5	ZB	2.48	1.00	1.00	2.40
VAIL	VA	2.50	1.33	.20	2.60
VAIL	VM	2.48	1.33	.20	2.60
VAIL	W9	2.48	1.33	.20	2.60
VAIL	VV	2.35	1.33	.20	2.58
VAIL	VW	2.48	1.33	.20	2.40
VAIL	8WR	2.48	1.33	.30	2.36
WIXC	JS	1.00	1.00	1.00	2.60

Figure I.30. MG Part Product Summary Report.

Monthly Summary Report

magnecomp (thailand) ltd.

Summary of GA Machine

8/8/00

GA_TYPE	GA_NO	GA_NAME	DATE
AUTO FEED			
AUTO FEED	G002	GA MACHINE	3/7/00
AUTO FEED	G001	GA MACHINE	3/7/00
AUTO FEED			
GAM			
GAM	GAM003	AUTO FEED	3/8/00
GAM	GAM002	AUTO FEED	3/8/00
GAM	GAM001	AUTO FEED	3/8/00
GAM			
MGM			
MGM	MGM004	MANUAL	3/8/00
MGM	MGM003	MANUAL	3/8/00
MGM	MGM002	MANUAL	3/8/00
MGM	MGM001	MANUAL	3/8/00
MGM			
PRPDUCTION			
PRODUCTION	GAM010	AUTO FEED	3/10/00
PRODUCTION	GAM009	AUTO FEED	3/10/00
PRODUCTION	GAM008	AUTO FEED	7/3/00
PRODUCTION	GAM007	AUTO FEED	7/3/00
PRODUCTION	GAM006	AUTO FEED	7/3/00
PRODUCTION	GAM005	AUTO FEED	7/3/00
PRODUCTION			

Figure I.31. GA Machine Summary Report.

Exception Report

magnacomp (thailand) ltd.

Individual Customer Record

8/8/00

C_CODE	C_NAME	Country	STREET_ADD	CITY	STATE
1	Lomege	Japan		Tokyo	
2	Kaifa	Japan		Tokyo	
3	CG	Thailand		Bangkok	
4	Hson	U.S.A		Tumacla	Calfornia
5	Fimage Technolo	Hong Kong			
6	Mfield Manfactur	Hong Kong			
7	Fimage Technolo	Chnia			
8	Mfield Manfactur	Chnia			
9	MG International	Singapore			
10	Adity Software L	India		Banglore	Karnattaka
11	Mg Corporation	India		Heydrabad	Andera Pard

Figure I.32. Individual Customer Record.

Exception Report

magnecomp(thailand) ltd.

Individual Customer Orde

17/8/00

USTOMER CODE	ORDER NO	COMPANY NAME	CUSTOMER O DATE	CUSTOMER D DAT
1	1001	Lomege	12/1/00	30/1/00
1	1002	Lomege	12/1/00	25/1/00
1	1003	Lomege	12/1/00	31/1/00
1	1008	Lomege	10/2/00	25/2/00
2	1007	Kaifa	9/2/00	25/2/00
3	1006	CG	31/1/00	21/2/00
4	1005	Hson	31/1/00	21/2/00
5	1004	Fimage Technologi	25/1/00	5/2/00
6	1016	Mfield Manfacturin	5/3/00	31/3/00

Figure I.33. Individual Customer Order Report.

Exception Report

magnecomp (thailand) ltd.

Individual Machine Product Part Report

8/8/00

PART_NO	PRODUCT_NO	GRAM_LOAD	GRAM_LOAD	RAGET_CPK	ARGET_RANE
8A **8A**	T-850	5.58	5.50	1.33	.35
8WR **8WR**	VAIL	2.48	2.48	1.33	.30
DD **DD**	WISCO	1.00	1.00	1.00	1.00
GL **GL**	JAZZ	3.48	3.43	1.50	.30
GM **GM**	JAZZ	3.48	3.43	1.50	.30
HE **HE**	MILLENIUM	2.59	2.59	1.50	.20
JS **JS**	WISC	1.00	1.00	1.00	1.00
SJ **SJ**	BULLY	1.00	1.00	1.00	1.00
TA	MILLENIUM	2.59	2.54	1.50	.20

Figure I.34. Individual Machine Product Part Report.

APPENDIX J

DATA DICTIONARY

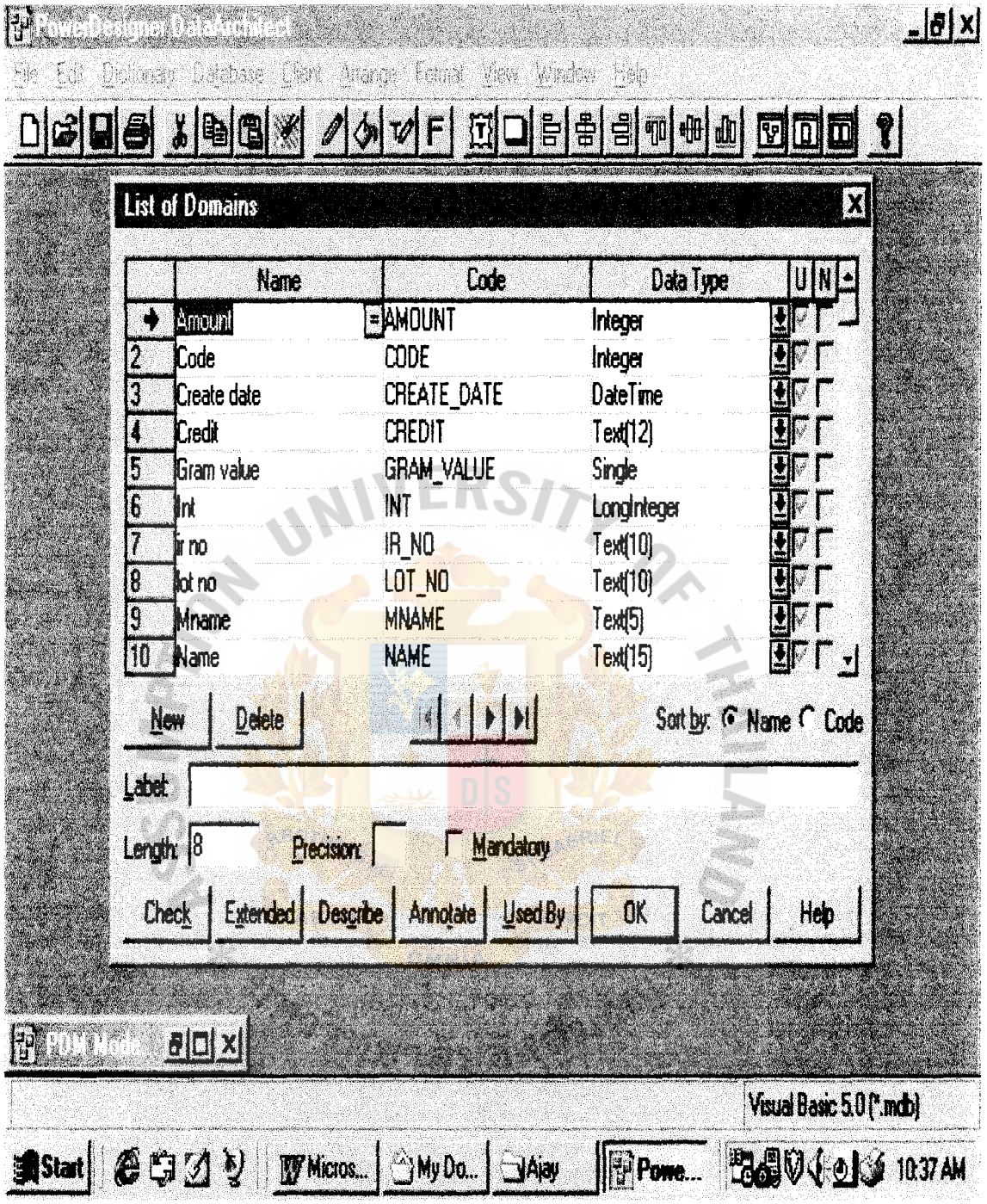


Figure J.1. Data Dictionary.

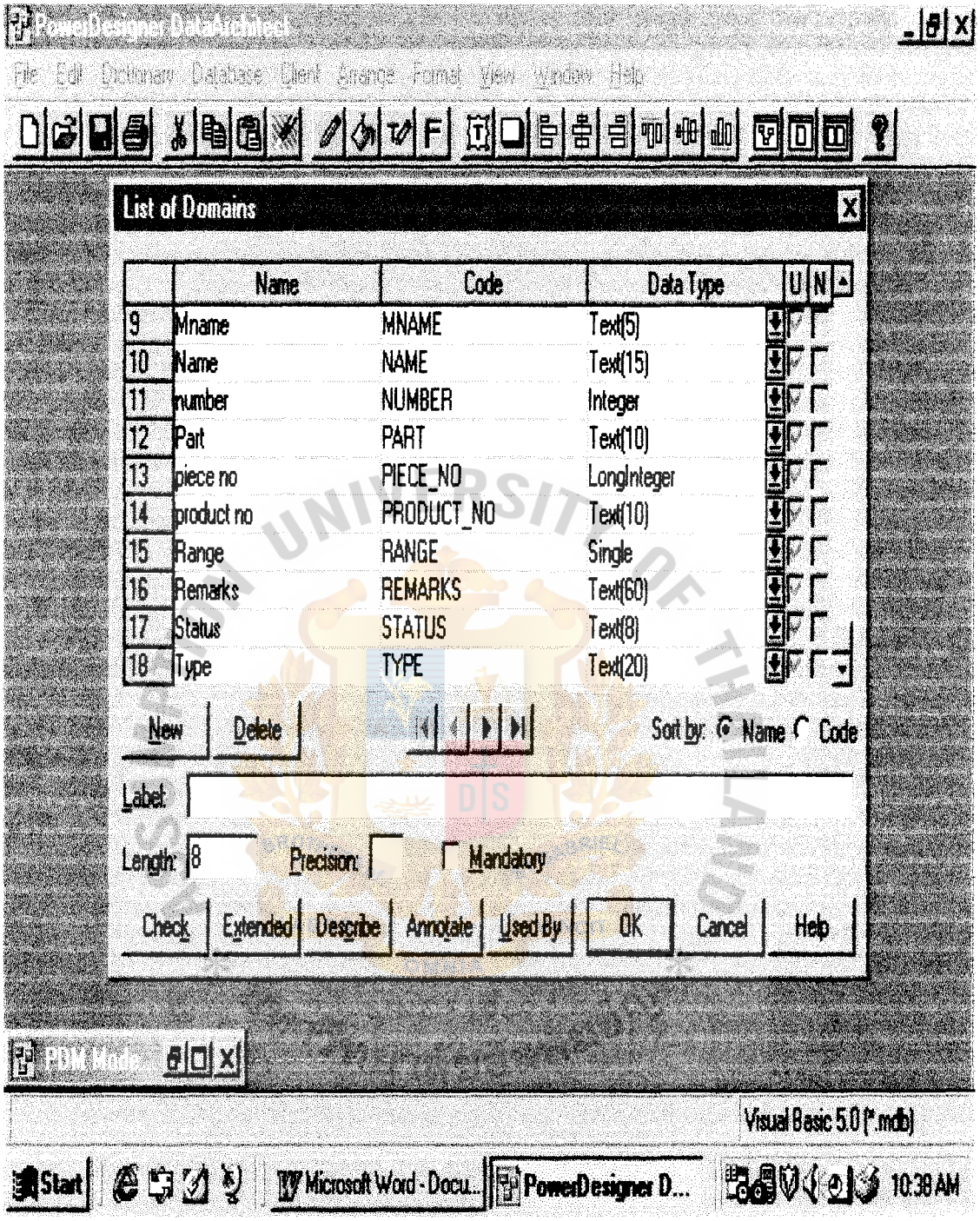


Figure J.2. Data Dictionary (Continued).

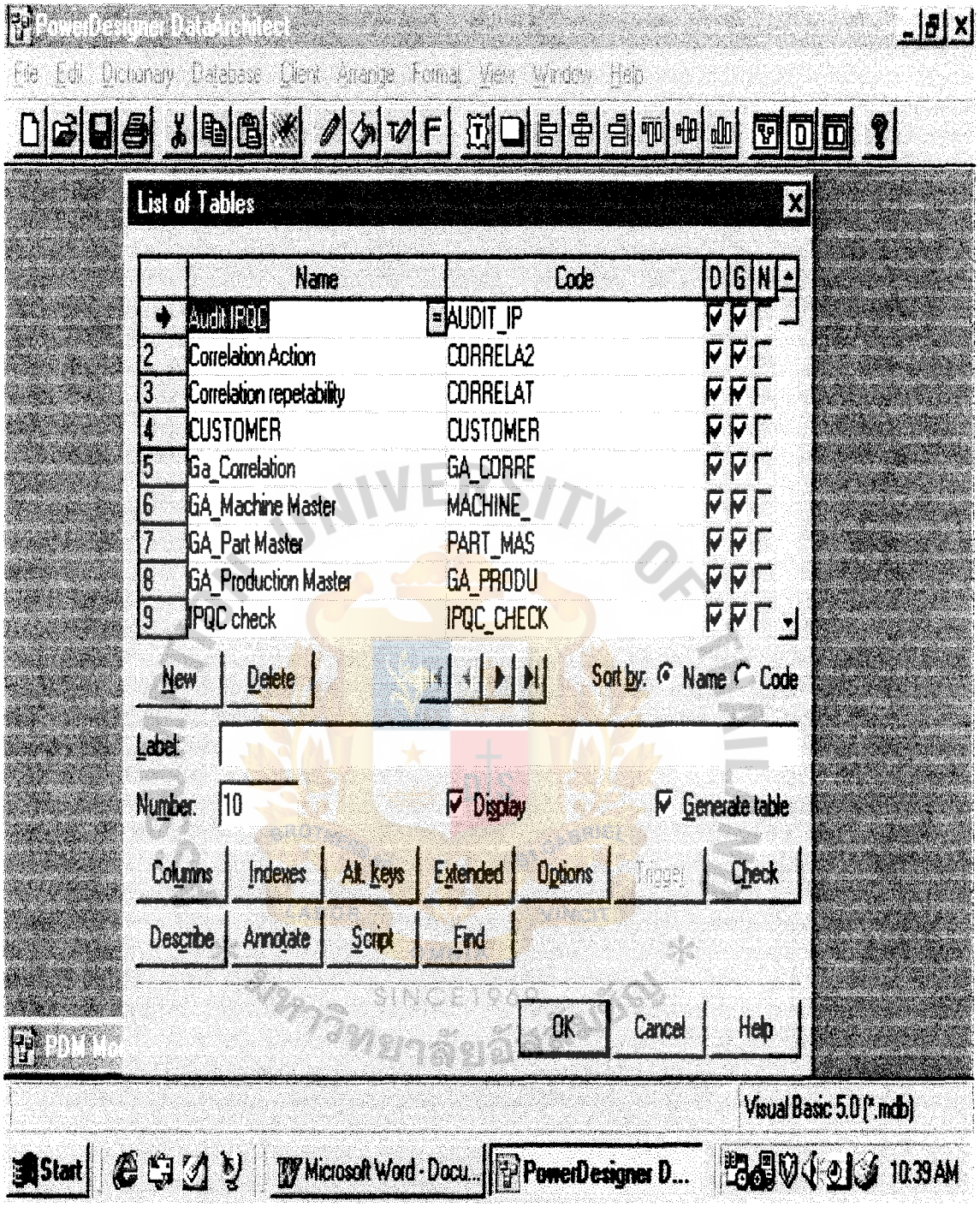


Figure J.3. Data Dictionary (Continued).

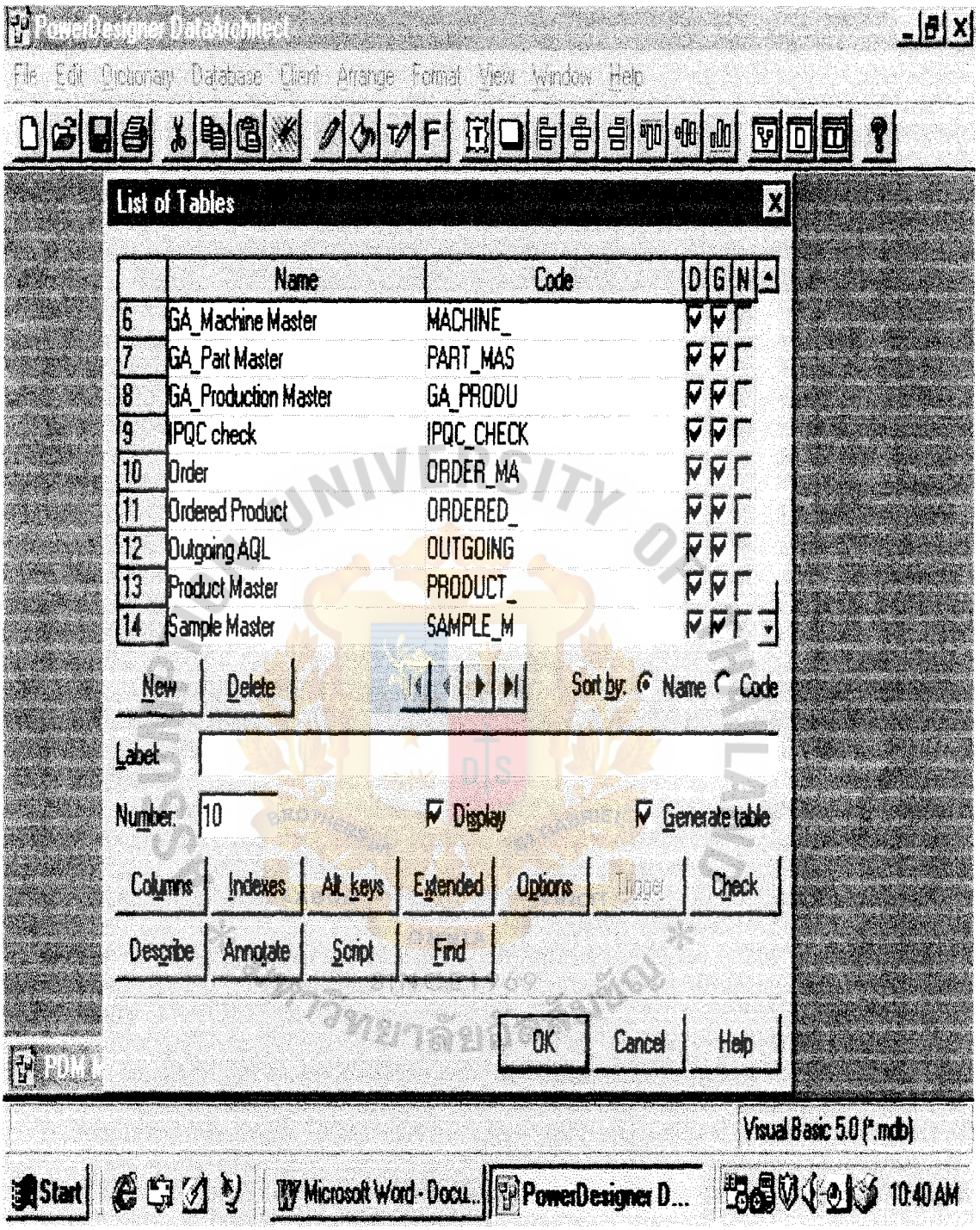


Figure J.4. Data Dictionary (Continued).

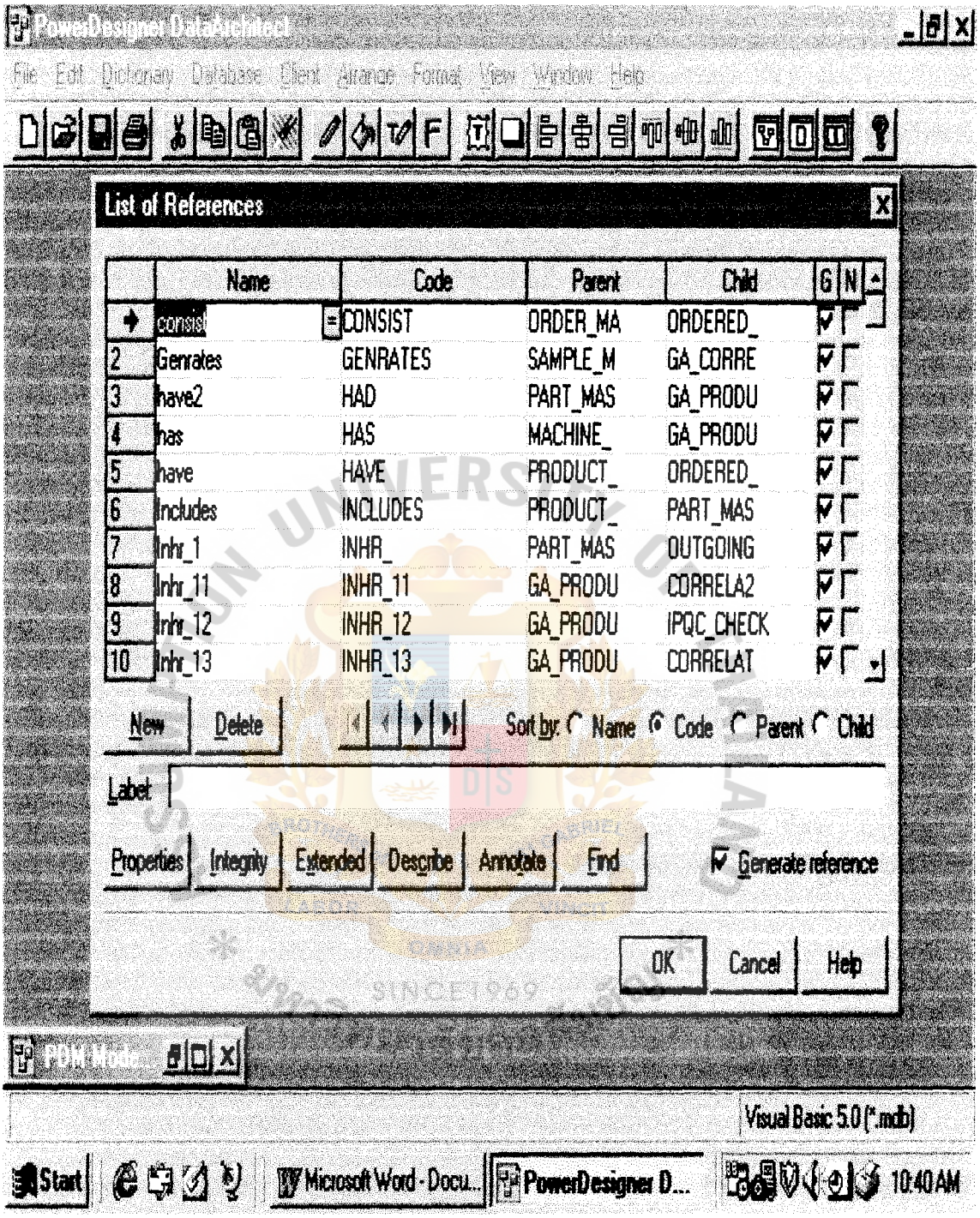


Figure J.5. Data Dictionary (Continued).

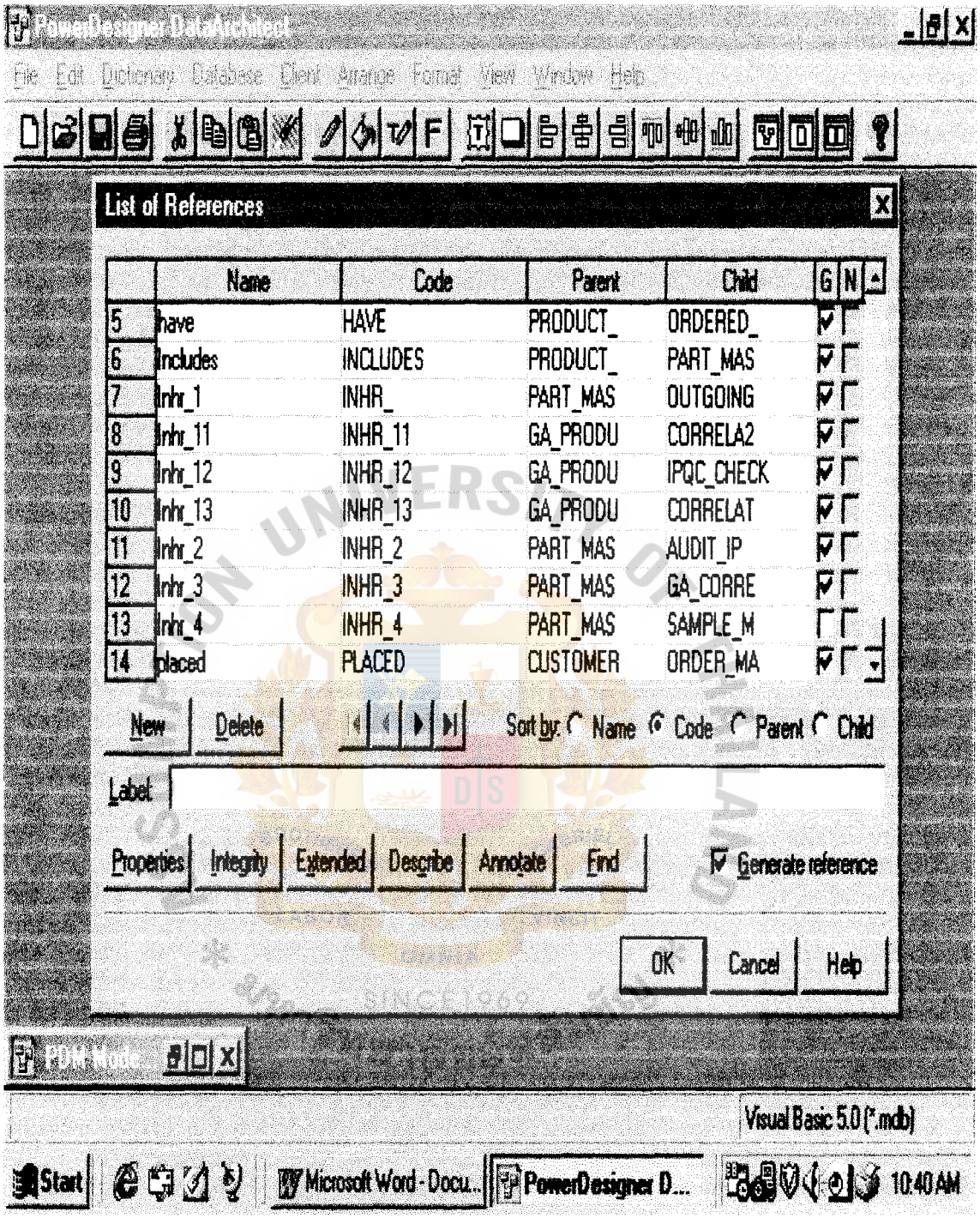


Figure J.6. Data Dictionary (Continued).

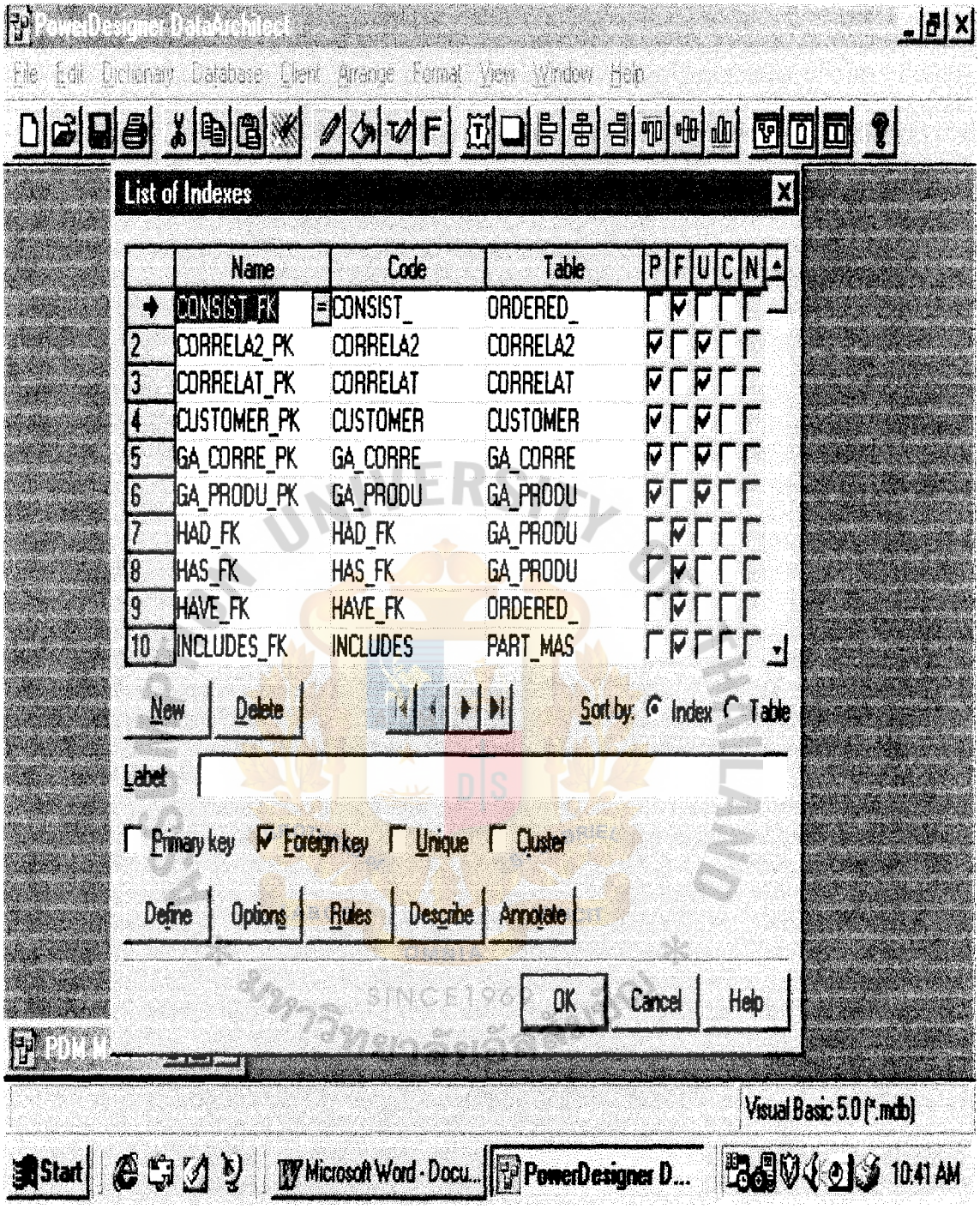


Figure J.7. Data Dictionary (Continued).

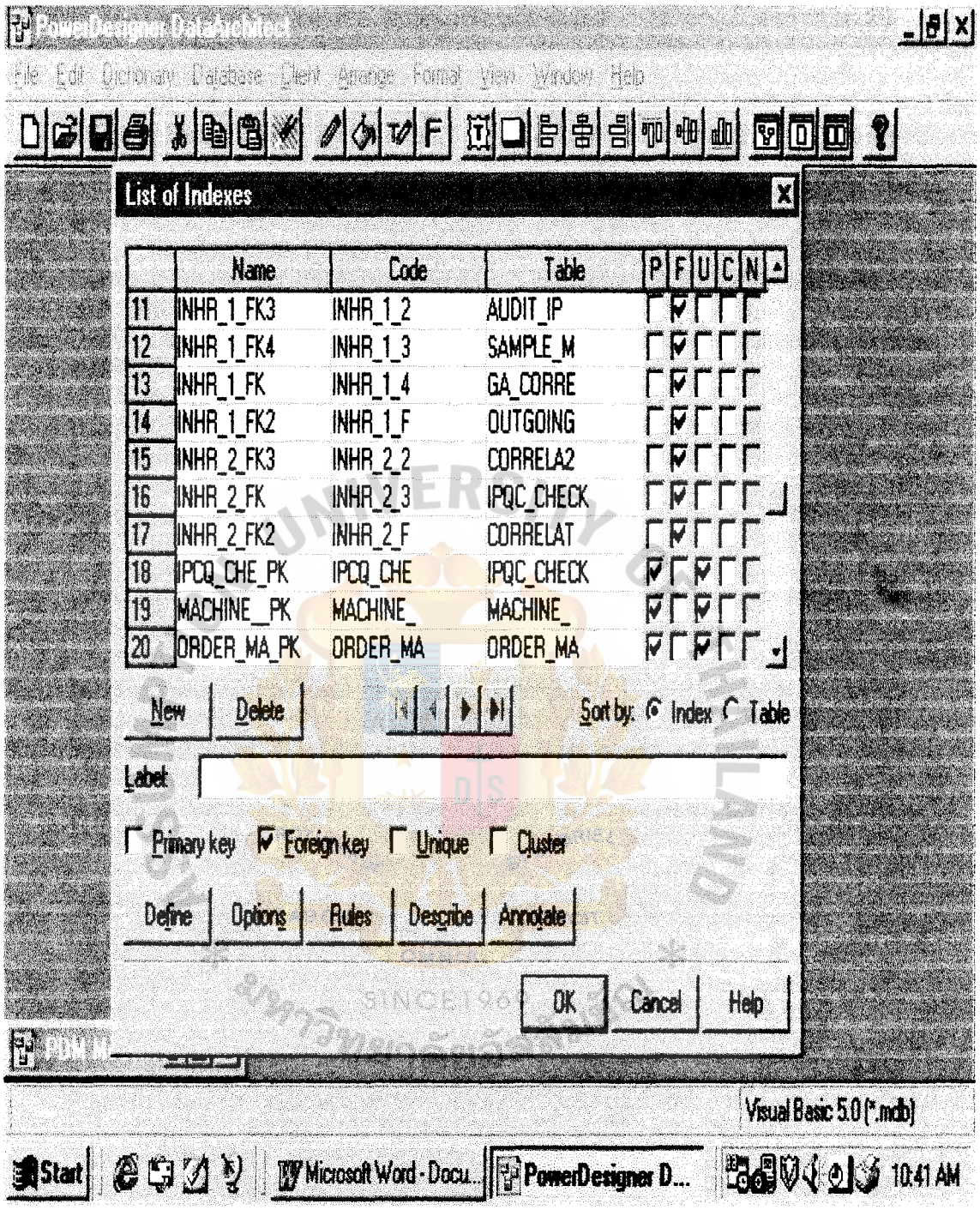


Figure J.8. Data Dictionary (Continued).

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