PROJECT 3:

The Puget Sound Health Clinic Database System

CSE100/INFO 100 Fluency with Information Technology Spring 2002

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Introduction

This next section of this course is an overview of database technology and relational database design. While learning the concepts behind database design is helpful, one can only plan on mastering those concepts by working through an actual project. This project is intended to improve your understanding of databases and to provide an opportunity to study how the information system of an organization is created to serve its specific needs.

Your goal is to build the database application for an imaginary regional health clinic to be called the Puget Sound Health Clinic (PSHC). The clinic provides a variety of services and referrals, but the project will be limited to the clinic's lab testing activities. The clinic performs drug testing as well as testing for a variety of diseases: HIV, AIDS, Hepatitis B, etc. An important aspect of the database system is to assure privacy for the clients. A receptionist and several health professionals staff the clinic. The database system is intended to support their daily testing activities.

Understanding what things (items, people, events, etc) are important to an organization and need to be tracked is the first step in any database system design. The next step is to identify how all of those things associate with one other. By exploring how an organization works and how information flows through it, you can identify those items most important to the system.

Context

In a real world design process, the database developer or team spends many hours interviewing the system users and tracking organization flow in order to identify the many items, events, actions and people that it is necessary to track. In these interviews a model of the system will be developed. *This section is intended to replace many of those interviews.*

This database is intended to support the processing of clients who come to the clinic to have a test performed. During their visit they will give personal information, be seen by a health

professional and provide one or more fluid specimens for testing. The actual tests are not performed at the PSHC, but rather are performed at one or more labs in Seattle. This means that the specimens must be sent out; when they are returned the client is notified. It is assumed that the PSHC is a public health clinic, the testing is free and its employees are volunteers – so there will be no need to include any kind of payroll or billing system.

Look at the flow of information through the clinic as a guide to the design.

Arrival:

When a client arrives, the receptionist interviews him or her to gather a small amount of personal data that is entered into the client's record. If the client has visited the PSHC before, the receptionist simply verifies the information in the existing record. The receptionist is then responsible for scheduling the client with one of the health professionals.

All appointments are for the current day (this is a walk-in clinic) and are set up on a first come, first serve basis. Any emergency cases would immediately be diverted to the local emergency room and not dealt with in the clinic.

Meeting With the Health Professional:

After the client has waited for the health professional to be free, the health professional interviews the patient to find out a brief medical history and the type of test(s) sought. The health professional fills out a form that is a record of the clinic visit and the discussion. The form has space for "chart" information as well as check boxes for the tests to be given, including an "exceptional" situation.

If tests are ordered by the health professional (i.e. one or more check boxes have been checked) then a specimen (urine, blood, etc.) will be collected from the client to be sent to the lab. A label must be generated to attach to the sample. The label must include the pertinent information about the test and the person requesting it. To assure privacy a tracking number is used whenever a client must be identified outside the clinic. The number is not randomly generated, but neither is it easily identifiable with a particular client.

Lab Manifest:

Each day the lab test samples will be gathered together. An employee compares all the specimens against a computer generated "lab manifest" listing all of the requested tests by tracking number. After making sure that all specimens are accounted for, each set of test specimens is then grouped (Aids, HepB, etc.). The same employee will print each individual test manifest, check that all specimens exactly match, and ship them to the appropriate lab with that paper manifest (e.g. Aids). An electronic version of the manifest may also be sent to the lab.

Results Returned:

The lab will return the manifest. The results of each test will be filled in. The outcomes are: positive, negative, failed (must be repeated), inconclusive, and exceptional. When the results of all tests requested on a particular visit are available, a letter to the patient is generated. In the case that the test failed, the client is encouraged to return to provide another specimen, which will produce a separate visit transaction. Once the letter is generated, the visit is "closed". To assist the clinic's administration and public health officials, summary statistics are generated each quarter. These include the number of clients visiting, and summaries of the outcomes, i.e. number of positives, negatives, etc. in each category.

Analyzing all of the previous description will reveal those entities (items, people, actions and events) most important to the clinic that should be tracked.

Needs Analysis: Identifying Important Entities

The actions and processes described above give us an idea of the items, people, events and their relationships to each other that need to be tracked. Once identified, they become components of the system. These and additional components are necessary to support the clinic's daily operation and should be included in the basic database design. They are numbered in the following description.

From the Arrival description, it is evident that tracking Client information is very important. A Client table (1) is required to hold that information. This will contain

- An ID number for the client (specific to the Health Clinic)
- The client's name
- Contact information
- Birth date
- Date client first entered system (Date record is added)

In order to help the receptionist to enter information into this table, a form (2) is required. The form should be attractive, be embellished with the lab's name and look suitably professional. Once new client information has been added to the table through use of the form, the receptionist will schedule the client with a health professional. The scheduling of a visit between a doctor and patient will require opening an additional form that can start a visit record with the appropriate information. A mechanism must be provided for doing so.

From the Meeting description, there must be a Health Professional table (3) containing important information about each volunteer doctor, nurse, etc. This table should hold:

- Clinic Volunteer ID (specific to the Health Clinic)
- First and Last Name
- Degree (RN, MD, etc)
- Contact information
- State health license number
- Social Security Number
- Notes (days available to volunteer, etc)

There is a form **(4)** for entering data for this table that is attractive and consistent in design with the other forms.

Also from the Meeting description is the fact that each event of a client seeing a health professional should be recorded. The table to hold this data is called Visit **(5)**. The table will include:

- The ID for the Visit
- The client's ID from the Client table
- The Health Professional's ID from the Health Professional table
- Tests requested (need a field for each test)
- Test outcome data (need a field for each test outcome)
- A tracking number
- Recent Medical History (since last visit)
- Current Symptoms
- Remarks/Notes

The tracking number is not the unique record ID for that table (that is another attribute). Instead it is a multi-digit number used to identify the specimens. This number preserves the

anonymity of the client while the specimens and tests are being processed outside the clinic. One tracking number is associated with each visit of a client, and so if more than one test is ordered on a single visit, the same tracking number will be used on each. There should be a field to record the outcome of each test, once it is returned.

The scheduling of a visit between a doctor and patient by the receptionist will require use of a form **(6)** that can start a visit record with the appropriate client and doctor information. The receptionist needs to view different pieces of data than the health professional. The Reception desk is only concerned that:

- The Visit be uniquely identified from any other that day
- The proper client identification number is noted
- The proper health professional identification number is noted

For the interactions between the client and the health professional, another form (7) for entering the additional data will be created for this table. It should be set up with:

- The Visit identification number
- The date of the visit (to verify the record is not from another time)
- The client's name: first and last
- The health professional's name: first and last
- Health professional certification (RN, MD, etc)
- A way to show if a test should be ordered
- The tracking number
- Notes fields (symptoms, history, remarks, etc.)

For each test requested, a label **(8)** must be printed to be affixed to the specimen. This label includes the clinic's name, address and phone number, the date and the tracking number.

From the Lab Manifest description, it is necessary to create **(9)** a complete manifest of all tests to be sent to the labs with the specimens that:

- Lists the tracking numbers for all requested tests
- Shows the checked boxes for each test as confirmation that it was ordered.

From the complete manifest each individual test manifest will be created to send to the various labs. Though a paper copy is sent with the specimens, an electronic copy should also be sent to the labs showing the tracking numbers requesting that test. This way the clinic and the lab can each run a check of specimens against the test manifest.

The Results Returned description explains that the lab will return the manifest for each test set submitted to it. The test manifests will come to the receptionist who will enter the results fields each test. There will only be one of 4 possible results listed (positive, negative, etc). This requires a form for easy data entry by the receptionist (10). The information that the receptionist sees, however, should be limited to the tracking number and the outcome field for entering the results.

From the Notification description, there must be a letter (11) generated to the client once all of the tests from a visit have been received. The letter reports the results of each test. If any test's outcome is "fail" or "inconclusive", a paragraph is inserted recommending that the client return to the lab for a retest. Notice that since a single letter is generated for (possibly) multiple tests, sorting the merged Lab Manifest table on the tracking number field will result in grouping together the tests of one visit. Once the letter and a mailing label (12) have been generated, the record can be closed and moved from the Visit table to the Visit Archive table (13). Similarly, all returned Lab Manifest table records that have been

reported should also be moved to the Lab Manifest Archive table (14). The summary statistics report (15) is generated from the Lab Manifest Archive table. The statistics are (a) the number of visits, (b) the number of tests, (c) the numbers of tests of each type and the outcomes. In addition, there should be a summary of the number of visits by month for each month in the quarter.

Finally, because of privacy practices in the medical field and possibly state laws, the database must be password protected. Further, it should contain an "auto close" facility that exits the database when no activity has occurred for a while. This will protect unintended access when the health professional leaves the computer.

Summary

The following components of the PSHC information clinic were identified in the Needs Analysis section:

Client table
Client table entry form
Health Professional table
Health Professional table entry form
Visit table
Reception Visit record entry form
Health Professional Visit record completion form
Specimen label
Lab Manifest table for each test, created daily
Test results entry form
(Notification letter to client containing test results)

Not Part of Project 3

(Mailing label to client)

(Mailing label to client)Not Part of Project 3(Visit Archive)Not Part of Project 3(Manifest Archive)Not Part of Project 3(Clinic quarterly statistics)Not Part of Project 3(Password Protection of database)Not Part of Project 3

Part I: Understanding and Designing the PSHC Database Structure

The goals of Part 1 are:

- 1. Understanding the flow of information through the Health Clinic
- 2. Create the basic tables and forms that will make up the database
- 3. Establish the relationships among the fields of the database
- 4. Start the client visit process within the system

Task 1: Understanding the flow of information

The purpose of this task is to visualize the flow of information and how it should be embodied in a database. Write a narrative description of a particular client's visit to the PSHC, describing the flow of information that takes place. The narrative begins, "<Name of client> walks into the PSHC, is greeted by the receptionist and sits down at a chair by the reception desk....". From here, your narrative should describe the information flow process: what information is transferred, from whom and to whom. The people and places involved in the information flow are the client, the receptionist, the health professional and the testing lab. You should explicitly state how information in input to the system, who it goes through and where it is stored.

Task 2: Build the Basic Database Structures and Create Simple Data Entry FormsNow that you have tracked the information flow through the PSHC system, it's time to build the structures that have been identified to hold the information considered important enough to track.

- A. Create the structures for three tables: **tblClient**, **tblHealthPro**, and **tblVisit**. These tables must have at least the fields (attributes) listed below in the screen captures and have the same properties. Any directions concerning the creation of each field have been listed in the Description column. It will be up to you to change the names of the fields so that they are descriptive of the attribute they hold, but don't include any spaces or punctuation. The names of the examples have been made very long on purpose. Find a shorter, descriptive name.
- B. Create a Form that enters data into the tblHealthPro table. Call the form **frmClinicHealthStaff**. Make the form attractive and easy to read (change the color, font, layout, etc.) for the user who will eventually have to add data to the system with it.
- C. Create another form to enter data into the tblClient table. Call the form **frmClient**. Make the form attractive and easy to read (change the color, font, layout, etc.) for the user who will eventually have to add data to the system with it.
- D. Using the two forms you have created, add four sample entries to the tblClient and tblHealthPro tables. Use names of family members for the Health Professionals and friends for the clients.

Task 3: Build Relationships

The purpose of this task is to relate the information in different tables based on a single attribute so that eventually the information can be associated into an integrated whole.

A. Establish that Client records have a one-to-many relationship with Visit records, and that HealthPro records have a one-to-many relationship with Visit records as well. That means that a client could participate in one or more visits to the clinic and a

health professional will also participate in one or more visits. What attributes would seem the most likely to show these relationships?

Task 4: Start the Client Flow Process

The purpose of this task is to support the receptionist and the health professional in their meetings with the clients. :

- A. Create a form called **frmAppointment** that contains the following information (fields) from the **tblVisit**: VisitID, ClientID, HealthProID
- B. Add a button to the **frmClient** form in Design View that will open up **frmAppointment** and show only the data related to the client whose record shows in frmClient. Use the Tool Wizard to accomplish this. You will need to explore the options the wizard provides to you.
 - When the form is completed, notice that the receptionist can click on the command button in form view and add the data that starts a new row in the Visit table. This sets up the client for consultation with the health professional that day. If the client has had any prior visits, those will also be displayed.
- C. Improve the look of frmAppointment by adding a combo box that will allow the receptionist select the Health Professional's name and the appropriate ID will be stored in the HealthProID field.
- D. A nice additional feature (but not required) to the frmAppointment would be a way to move to the last record in a set of Visits for a particular Client.
- E. The last thing to do is set up several appointments (Visits) between the Clients and Health Professionals you have added. Check to see that the current date appears on the visit. For part II you will generate more seed data, but for now, test your form.

Part I Turn In

Part I is due at Midnight on May 29^{th} . Turn in a hardcopy of the paragraph from Task 1 in class on Friday, May 31^{st} .

BEFORE TURNING IN YOUR DATABASE, BE SURE TO "COMPACT AND REPAIR" IT USING THE INSTRUCTIONS GIVEN TO YOU IN LAB.

<u>Part II: Finishing the Client Visit and Processing Samples in the PSHC Database</u>

The goal of part II of the project is to complete the first portion of the client visit and support the processing of samples and recording of information. Specifically:

- 5. Generate the guery and form to continue the client processing through the system
- 6. Implement a tracking number for the set of tests requested on each visit so lab testing is anonymous
- 7. Generate test data
- 8. Understand and implement a query to create a manifest list for each type of test
- 9. Using a report wizard construct a paper list of all tracking numbers requesting a particular test and print labels for each.
- 10. Create the query that could eventually be used with a form to assist the receptionist in recording the test results for each Client.
- 11. Reflect on issues of Privacy surrounding database use and creation.

Task 5: Continue Client Flow

The purpose of this task is to support the health professional in their meeting with the clients.

- A. Using the QBE, create a query that will select information for display from each of your table structures. Decide what information you would like gathered from each table. Your choice should limit the information to just the essential data required for the consultation between client and health professional. For example, selecting the client first and last name is essential, but the health professional's address is not. Start your list with the following fields, the rest will be up to you to determine:
 - The visit identification, visit date, client identification, and health professional identification from the Visit table.
 - (HINT: None of the tables used in the query will have ALL of their information displayed.)
- B. Save the query as **qryConsultation**
- C. Now, create a form in design view. Save it as **frmConsultation**. This form will be used by the health professional to record their visit interaction with the client.
 - In the properties of the form, select as the Record Source the query just created.
 - A window showing the attributes selected for the query should appear.
 - If you forgot to add a particular attribute, simply save and close the form, open the query, make the adjustments, save it and close it. Go back to the form design view and find the field list under View>Field List.
- D. Add the various fields to the form and arrange them in a pleasing manner. Adjust the color or background of the form by exploring and finding the appropriate properties window for different form areas in design view. Edit it to look attractive and easy to read.

For example, you will want to display the health professionals name so that they know this client is their responsibility, so you may list them at the top of the form and place a divider between their name and all the client information.

Task 6: Set Tracking Number

Before starting this task, let's look at the tracking number in a little more detail.

The tracking number is a unique number used to label specimens when they leave the clinic for testing. The main goal is to assure client anonymity, so the number should not be easily traced to the client. In the tasks for Part II, the tracking number is the way to refer to the client. The tracking number is only generated when the tests are ordered (in other words, when the client consultation with the health professional is over).

Using the Tool Box in Design View, add a command button to the Consultation Form. The caption of the button should be "Order Tests" and the Name should be **cmdOrder**. The code to be added to the cmdOrder_Click event is shown in the Appendix below.

- A. Use the wizard process to add the button for this operation. Place the button, select Form Operation and "Refresh form data" for your options.
- B. When you have finished adding the button, add the additional code (shown below and also found at the end of the Appendix) to the click event by going to View>Code on the Menu bar. Because you are using a wizard to add the button, there is a lot of code generated by Access using Visual Basic for Applications. The portion you will add must be placed at the location listed in the appendix below.

This is what happens in the code: When the Order Tests button is clicked at the end of the consultation, the tracking number field, which is normally locked to keep someone from accidentally editing it, is unlocked. The text in the field is set to (assigned) a letter string using the code given below and relocked. The code is part of the click event handler.

So, to add in the correct code piece you need to know the name of the tracking number text box on your form. In the click event for the command button, at the point where you are shown in the screen shot below, enter statements that will:

- C. Place the cursor at the tracking number text box
- D. Unlock the text box
- E. Assign the text box this value
 "PSHC" & Hex((12*(Year(Date) Year("04/02/02")) + _
 Month(Date)) * 1000000 + VisitID)
- F. Relock the text box

The assigned value simply adds a hexadecimal number to the letters "PSHC". The hexadecimal number encodes the number of months since the system was built times one million plus the VisitID.

Task 7: Generate Test Data

Test the functionality of your system with the following:

- A. Use the form generated to enter Client data to start several new Visits between Clients and Health Professionals.
- B. Once you have started the visits, go to the Consultation form and view the new data that has been added.

C. Request a variety of test for the different clients and generate the tracking numbers to order the tests.

Task 8: Build Virtual Manifest Tables with Queries

- A. Construct a query that will pull all tests requested for the current date. The query information comes from the Visit table and requires:
 - The tracking number to be shown
 - The date (only Visit records for the current date are to be listed)
 - The request field when at least one test request field (the checkbox) has been checked. This is giving you a hint about establishing query criteria. There is no programming involved.
- B. Once you have this data retrieved, save the query as **gryMainManifest**.
- C. Use this query as the base for constructing each individual test manifest. These queries should be called **<test>_Manifest**, where **<**test> is the name of one of the five tests. Show only the tracking number and date for the individual test manifest, but use the test request as criteria.
- D. Look at the SQL View for the queries generated with the QBE in Access. For one of the individual test queries, write a sentence saying in words what the query is doing. Identify each clause of the query and say what it is referring to (the particular field, table/query or constraint). This write up should just be a description, line by line, of the SQL and is to be put just before your reflection paragraph for Task 9.

Task 9: Paper Manifests and Labels

- A. Using the Report wizard create the manifest list for each test from the Manifest "tables" of Task 8. The lists should give the tracking numbers and dates, as well as the name, address and phone number for the clinic at the top. Use **rpt<test>** to name the lists.
 - Go into design view to make any changes that aren't taken care of properly with the wizard.
- B. Using the Label wizard (part of Reports), create labels for each specimen. The label should have the tracking number, the date, the name of the test requested and the name, address and phone number of the PSHC. Use **Ibl<test>** to name the lists

Task 10: Recording Results

Generate the queries that are used to reconstruct the manifests in Task 6. It is assumed that the results are written on the test's manifest at the lab, and that the list is returned at some time in the next week.

- A. Using a query construct a virtual table (a view) for each test that is similar to the manifest queries in Task 7, but with the added field for outcome for that test.
- B. Unlike Task 6, the criteria for date should not be the current date, but instead should be equal to a date typed in by the receptionist. By making the criteria for that field a request set in square brackets: [Enter Date Tests Were Requested] the query

will prompt the user for a date when it is run.

C. Name each Result query: **<test>Results** where <test> is Aids, HepB, etc. You do not have to create the forms to enter the results, although this would be a logical component to include in the system.

Task 11: Reflection

Add two paragraphs just after the SQL explanation for Task 8. Reflect on how well your system works. Use these questions as a start to your reflection:

- A. Are there things that you would change? Why?
- B. Are there things you could add to make the system more useful? For example, if the medical professional meets with the client to explain verbally the outcome of the tests, what database support do you think that activity would require?

Add a final paragraph discussing the privacy issues in the design of this type of database:

- C. How does the design help to protect privacy?
- D. From a privacy perspective, what things would you change to improve privacy on this system. Be specific. Do not simply say "Add password protection to the database".

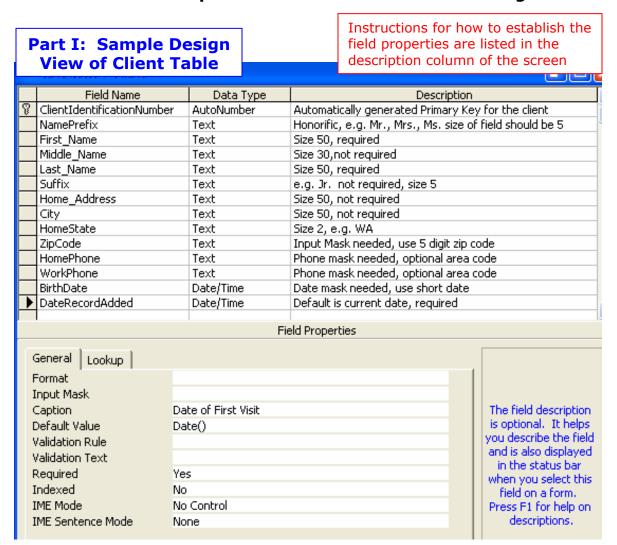
Part II Turn In

The Part II database is due at 9 pm on Friday, June 7th. In class **that day (June 7th)**, submit a hardcopy of the SQL interpretation and reflection paragraph from Tasks 8D & 11.

BEFORE TURNING IN YOUR DATABASE, BE SURE TO "COMPACT AND REPAIR" IT USING THE INSTRUCTIONS GIVEN TO YOU IN LAB.

Appendix A:

Screen Shots of Sample Table Structures and Form Design

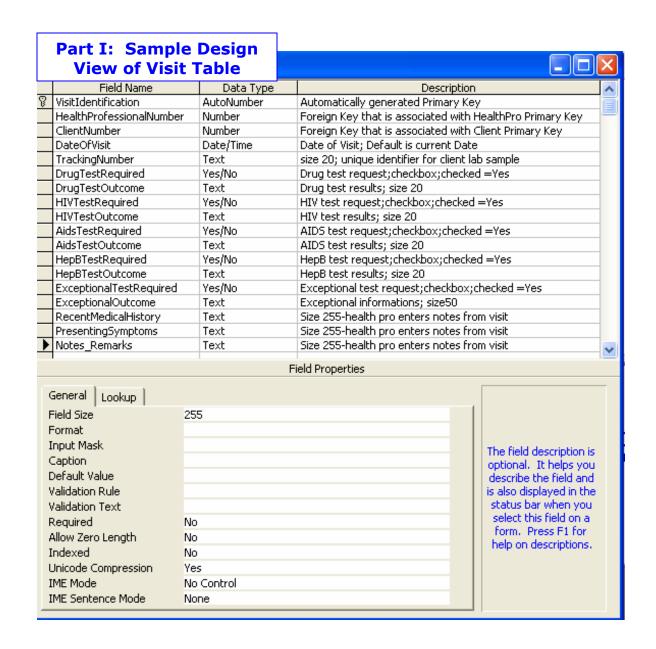


Part I: Sample Design View of Health **Professional Table** Field Name Data Type Description HealthProfessionalIdentification AutoNumber Automatically generated Primary Key SocialSecurityNumber Uses SSN input mask, not required Text HealthLicenseNumber Must have a mask structure ##-##### (create your own mask) Text FirstName Text Size 50, required MiddleName Text Size 30, not required LastName Text Size 50, required Size 5; example - MD or LPN; required Degree Text MainOfficeLocation Text Size 30, not required MainOfficeAddress Text Size 50, not required MainOfficeCity Text Size 50, not required MainStateOrProvince Text Size 2, e.g. WA Input Mask needed, use 5 digit zip code MainZipCode Text HomePhone Phone mask needed, optional area code Text WorkPhone Phone mask needed, optional area code Text Date mask needed, use short date Birthday Date/Time

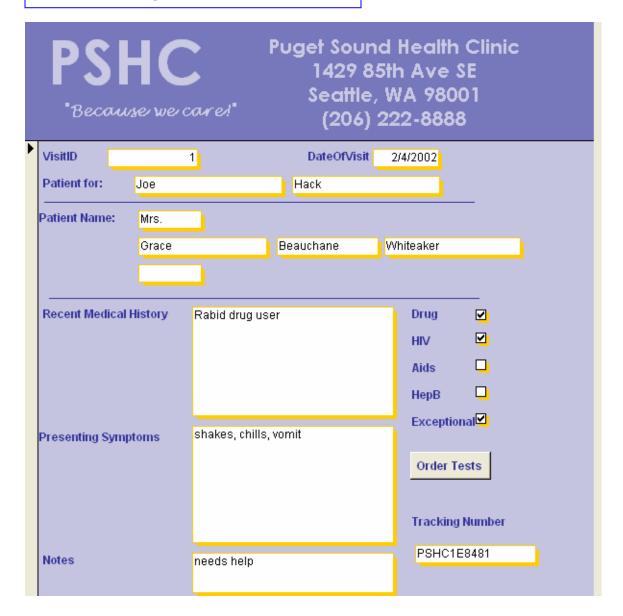
Field Properties

General Lookup Field Size 50 Format Input Mask Caption Last Name Default Value Validation Rule Validation Text Required Yes Allow Zero Length No Indexed Unicode Compression Yes IME Mode No Control IME Sentence Mode None

The field description is optional. It helps you describe the field and is also displayed in the status bar when you select this field on a form. Press F1 for help on descriptions.



Part II: Sample Consultation Form



Part II: Tracking Number Code to Add to Command button

Option Compare Database Option Explicit

Private Sub cmdOrder_Click()

On Error GoTo Err_cmdOrder_click

ENTER YOUR CODE HERE

DoCmd.DoMenuItem acFormBar, acRecordsMenu, 5, , acMenuVer70

Exit_cmdOrder_Click:

Exit Sub

Err_cmdOrder_click:
MsgBox Err.Description
Resume Exit_cmdOrder_Click

End Sub