Rutgers Business School: Undergraduate — New Brunswick
Management Information Systems (33:623:370)
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Practice Material for Final Exam

Format and Content

The final will be a three-hour cumulative exam. The planned format is:

- A short section on file sizes and data transfer times, with practice material in Section 1 below; you may also review the "Memory Storage Calculations" handout, the first midterm, question 3 of homework assignment 2, and page 19 of the class notes.
- Two questions on database design and one question on database normalization. Practice material may be found in Sections 2a and 2b below, respectively; you may also review both midterm exams, your class notes, and most of the homework assignments.
- A section on queries similar to the second midterm, with one database and four or five queries, with practice material in Section 3 below. You may also review the second midterm and the associated practice material.
- A multiple-choice section covering *all* the lecture material. Prepare for this section by studying both sets of lecture notes distributed in class (or a single combined set you may download from the class website). Time permitting, you could also review RT chapters 1-5, 10, TG.4, and TG.5, but studying the other materials mentioned here will likely be a more efficient use of your time. There is no multiple-choice practice material available. However, you should anticipate the questions to be fairly in-depth – many will be difficult to answer without careful study of the lecture notes.

1. Memory Calculations

You have produced a 3-minute marketing video presentation describing a new, fuel-efficient car. The video has 400 × 600 resolution, 25 frames per second, and 24-bit color. For the purposes of this question, you may ignore the audio component of the presentation.

(a) Without compression, how many binary-style GB of storage will the video occupy?

(b) How binary-style MB will the video occupy if stored via a compression algorithm that has an average compression factor of 20?

(c) A customer connects to the internet via a DSL line that downloads at 768 Kb/s. Estimate how many minutes it will take the customer to download the compressed version of the video.

2a. Database Design Practice Material

2a.i: Rent-a-Wreck

You are setting up a database for a local "rent-a-wreck" car-rental firm. For each vehicle in the firm's fleet, you want to store the license plate number, manufacturer, model, model year, date acquired, mileage when acquired, and special notes. Assume that all your vehicles are registered in the same state. Each vehicle is assigned to exactly one *vehicle type*, such as "economy", "compact", "intermediate", "convertible", "SUV", and so forth. Each vehicle type has a description, a daily rental rate, and a weekly rental rate.

For each of your customers, you want to store a driver's license number and state, first name, middle name/initial, last name, date of birth, street address, city, zip code, phone number, and alternate phone number. Assume that your insurance only allows you to rent to U.S. customers, and you do not have access to a zip code table.

Customers place reservations by specifying the type of vehicle they want, the date and time they wish to pick it up, and the date and time they intend to return it.

Vehicles may be rented both as result of reservations, and as the result of "walk-ins". When a vehicle is rented, you need to store which exact vehicle was rented, and by which customer. For each rental, you want to store the date and time the vehicle was rented, the date and time the customer promised to return it, and the mileage and fuel tank level at the time of rental. When a vehicle is returned, you also want to store the actual date and time of return, mileage upon return, fuel tank level upon return, and special notes.

Design a database to store all this information. Draw an entity-relationship diagram and write a database design outline. You may create "ID" fields as necessary.

2a.ii. Plumbing Parts

You have been assigned to design a parts database for a company that manufacturers plumbing fixtures. Each part is identified by an 8-character part number, and many parts are built out of pieces, which are parts themselves. For example:

Part #:	4MC73498
Description:	Shower valve mixer cartridge
Inventory:	2,340 units currently in stock
Contains:	1 plastic mixer shell, part # 4MS87349
	3 rubber O-gaskets, 12 millimeter diameter, part # 1OG3M12F
	2 balancing springs, part # 3BX34980

The database needs to keep track of the kinds of information shown above, including what parts are contained in what other parts. Furthermore, some parts have special properties:

- *Retail*: some parts (mostly complete faucet assemblies and the like) are sold as retail products. In this case, there is additional information associated with the part, such as wholesale price, suggested retail price, and shipping weight.

- *Replacement*: Some parts are sold as replacement parts through a nationwide toll-free service number. These parts have a replacement part price and a shipping weight.

Note that any particular part may be a retail part, a replacement part, both, or neither. If a part is both a retail and replacement part, its replacement part price may differ from its wholesale and retail price, and (because of different packing for shipment) its replacement part shipping weight may differ from its retail shipping weight.

Some parts may be obtained from outside suppliers, and in some cases more than one external supplier. Conversely, some outside suppliers may supply more than one part. Each supplier has an ID, a name, a phone number, and address information; assume all suppliers are domestic, and you do not have a zip code table. You order parts from external suppliers in "lots": for example, a particular supplier only ships rubber O-gaskets in packages of 500. The lot size and price per lot may vary by supplier; for example another supplier might only ship rubber O-gaskets in packages of 1000, and charge a different price per lot.

Design a database to store all this information. When possible, avoid having to store fields containing blank, "null", or "does not apply" values. Draw an entity-relationship diagram and write a database design outline. You may create additional "ID" fields as necessary.

2a.iii. Custom Cabinetry Shop

Bill Carpenter is creating a database to keep price list and ordering records for Wood-Maid Cabinetry, located in central Pennsylvania. The firm makes high-quality cabinets, mostly for kitchen renovations. Wood-Maid currently markets 65 different basic kinds of cabinet, each known by a 4- to 8-character code; for example, an "F24D4" is a 24-inch wide, four-drawer floor-standing cabinet. Each kind of cabinet has a base price, a description, and some additional information such as its shipping weight, the type of carton needed for shipping, the number of labor hours needed to build it, and the number of knobs or handles it needs. To fully specify a cabinet, however, the customer must also indicate:

- The kind of wood: Wood-Maid offers 6 different kinds of wood, each with a name and corresponding two-letter code (MA=maple, PI=pine, *etc.*). For each kind of wood, there is a percentage markup that is applied to the base cabinet price.
- The kind of finish applied to the wood: there are currently 15 different finishes, each with a name, a 3-letter code, and a percentage markup (again, applied to the base cabinet price). For example, a "natural" finish has the code "NAT" and has a markup of 0%. A "pickle" finish has the code "PIC" and a 5% markup.
- Door style: there are 31 different door styles, each with a name, a 4-letter code, a description, and a percentage markup.
- Hardware: "hardware" refers to knobs and handles, which Wood-Maid obtains from a single supplier. There are 52 different styles, each identified by the supplier's 5-character catalog code. Each style has a description and a price per knob/handle.

Wood-Maid's customers consist mostly of home improvement contractors. For each customer, Wood-Maid wants to store a company name, a contact first name and last name, a phone num-

ber, and an address, city, state, and zip (assume you do not have access to a zip code table). Each customer has a main Wood-Maid sales/design representative, who assists in kitchen design and choosing cabinetry. Each customer is also assigned to a backup representative, in case the main representative is not available. The main representative for one customer might be the backup representative for another customer. For each representative, we want to store a first name, last name, date hired, and telephone extension.

Customers place orders, which typically contain multiple cabinets: for example, three 24-inch 4-drawer floor cabinets, one 36-inch roll-out floor cabinet, and four 24-inch standard wall cabinets. To avoid costly confusion and mistakes, Wood-Maid requires that all the cabinets in a single order have the same wood, finish, door style, and hardware choice. For each order, we also want to store the date placed, delivery request date, and date shipped (for orders which are complete).

Design a database to store all this information. Your design should automatically enforce the constraint that all cabinets in an orfer have the same wood, finish, door style, and hardware. Draw an entity-relationship diagram and write a database design outline. You may create "ID" fields as necessary.

2a.iv. Law Firm

The Dewey, Cheatham, and Howe (DCH) law firm has grown significantly over the past decade, and is looking to move to an automated system for keeping billing records. For each case, the kind of information the firm wants to store looks like the figure shown on the next page.

Each attorney working at the firm has a unique 5-digit employee number and an hourly billing rate. There are many cases; every case is associated with a single client, but some clients have more than one case. When a client has several cases, those cases may have a different client contact names. Each case has a single "responsible attorney", who is your staff attorney responsible for coordinating all legal work on the case. As shown above, however, other attorneys on your staff can bill time to the case (for example, because of their special expertise in certain legal topic areas).

For most clients, DCH stores only the kind of information shown above: name, phone, and address information (city, state and zip code; assume you do not have a zip code table). However, about 5% of clients are *pro bono* clients for which DCH performs free legal work – for example, a non-profit organization that finds apartments for homeless families. Such clients are referred to DCH by the local legal aid society. For such clients, DCH also stores the date of referral by legal aid, the name and phone number of the legal aid case worker for the client, and the client ID number in the legal aid society's client database.

Attorneys who have not reached "partner" level within the firm have a supervisor, who is another attorney within the firm. You want the database to store information on these relationships, so it can be used for queries like "list all cases for which the responsible attorney is supervised by Ed Grossberg".

Case Number:	001782		
Client:	Name:	Metro Real Estate Holdings	
	Address:	675 Town Square Drive, Suite 702 West Apple, NJ 07756	
	Phone:	(201) 743-0992	
Client Contact Name:	Willa Jennings		
Case Opened:	3/31/2004		
Case Closed:	(ongoing)		
Description:	Client suing commercial tenant over severe damage to rental property		
Responsible Attorney:	Jay Sykes (employee # 00131)		
Billed Hours:	Jay Sykes (#00131)	3/31/2004	2.3 hours
	Kathy Li (#00274)	4/1/2004	3.0 hours
	Jay Sykes (#00131)	4/1/2004	1.5 hours
	Ed Grossberg (#00071)	4/8/2004	0.8 hours
	⋮	⋮	⋮

Design a database to store all this information. If possible, avoid having to store fields containing blank, "null", or "does not apply" values. You may create additional "ID" fields where necessary. Draw an entity-relationship diagram and write a database design outline.

2b. Database Normalization Practice Material

2b.i. Courses, Students, and Grades

Consider the following single-table database and illustrative sample data. Assume that each course has only one section and one instructor, and that each student has only one major.

StudID	StudName	Major ID	Major Name	Course ID	Course Title	Instructor Name	Instructor Office	Grade
11232	Bruce Green	623	MSIS	370:03	Information Systems	Sam Shine	Levin-215	F
11232	Bruce Green	623	MSIS	312:02	Marketing	Steven Parks	Core-315	B
11452	Ben Jaffleck	010	Accounting	425:03	Corporate Finance	LeeYun	Levin-324	A
12543	Jane Brown	360	Finance	370:03	Information Systems	Sam Shine	Levin-215	C
12673	Kate Taylor	010	Accounting	212:02	Micro-economics	Yao Zan	Levin-006	D
12673	Kate Taylor	010	Accounting	370:03	Information Systems	Sam Shine	Levin-215	B+
13459	Diane Weld	635	Marketing	421:01	Consumer Behavior	Steven Parks	Core-315	A

Redesign this database so that it is in third normal form, and write a database design outline. You may introduce additional "ID" fields if you feel it is necessary.

2b.ii. Interfunctional Teams

The CEO of a large firm has organized some interfunctional teams to study issues such as adopting an integrated IT platform and improving the process for new product development. To keep track of who is serving on what team, the CEO's secretary has created the following spreadsheet table (not all rows are shown).

Team Name	Date Team Formed	Employee Name	Employee Department Code	Full Department Name	E-mail	Phone Extension
IT Integration	7/8/2004	Bill Coddingford	IS	Information Systems	wcodd	5478
IT Integration	7/8/2004	Marsha Freidrich	MKT	Marketing	mfred	3499
IT Integration	7/8/2004	Gayle Rosenberg	OPS	Operations	grosen	0415
IT Integration	7/8/2004	Narendra Patel	R&D	Research and Development	npatel	7808
Development Process	2/6/2006	Yu-ching Pan	IS	Information Systems	ycpan	5482
Development Process	2/6/2006	Narendra Patel	R&D	Research and Development	npatel	7808
Development Process	2/6/2006	George Smith	MKT	Marketing	gsmith	3507
Demand Forecasting	3/31/2005	Marsha Freidrich	MKT	Marketing	mfred	3499
Demand Forecasting	3/31/2005	Gayle Rosenberg	OPS	Operations	grosen	0415

For example, the "IT Integration" team consists of Bill Coddingford, Marsha Friedrich, Gayle Rosenberg, and Narendra Patel. Each employee works for only one department.

Design a relational database to keep this same information in third normal form; draw an entity-relationship diagram and write a database design outline. You may introduce additional "ID" fields as necessary.

2b.iii. Print Advertising Placements

The following one-table database keeps track of your firm's advertisement placements in various magazines. For example, ad 101, a comical piece showing bears eating pizza, ran in the June *Field and Stream*, the July *Outdoor World*, the July 15 *Business Week*, and again in the August *Field and Stream*. Note that you also ran another ad, a futuristic piece showing a spaceship, in the July 15 *Business Week*. You may run the same ad in several different issues of a magazine, or different ads in a single issue, but you never run the same ad more than once in a single issue of a magazine.

PLACED(AdID, AdDescription, MagazineID, MagazineName, IssueDate,
PublisherID, PublisherName)

Ad ID	Ad Description	Magazine ID	Magazine Name	Issue Date	Publisher ID	Publisher Name
101	Bears eating pizza	F&S	Field and Stream	6/1/2005	ZD	Ziff-Davis
101	Bears eating pizza	OW	Outdoor World	7/1/2005	NP	National Publishing Group
101	Bears eating pizza	BW	Business Week	7/15/2005	MH	McGraw-Hill
101	Bears eating pizza	F&S	Field and Stream	8/1/2005	ZD	Ziff-Davis
102	Spaceship	BW	Business Week	7/15/1005	MH	McGraw-Hill
102	Spaceship	PCW	PC World	8/1/2005	ZD	Ziff-Davis
102	Spaceship	AWST	Aviation Week	8/9/2005	MH	McGraw-Hill
103	Clown	NW	Newsweek	8/1/2005	NWI	Newsweek, Inc.
103	Clown	TIM	Time	8/7/2005	TW	Time-Warner
104	Chipmunks watching TV	F&S	Field and Stream	9/1/2005	ZD	Ziff-Davis
104	Chipmunks watching TV	TIM	Time	8/14/2005	TW	Time-Warner

Redesign this database so that it is in third normal form. Draw an entity-relationship diagram, and write a database design outline.

3. Query Exercises

Consider the following database, used by a service that manages construction projects:

VENDORTYPE(<u>VTypeID</u>, Description)

VENDOR(<u>VendorID</u>, Name, StreetAddress, City, State, Zip, Phone, VTypeID)
VTypeID foreign key to VENDORTYPE

CONTRACT(<u>ContractID,</u> VendorID, ProjectID, ScheduleStartDate, ScheduleDoneDate, EstimatedCost, ActualStartDate, ActualDoneDate, ActualCharged, WorkDescription)
VendorID foreign key to VENDOR
ProjectID foreign key to PROJECT

PROJECT(<u>ProjectID</u>, Name, Description, JobSiteAddress, JobSiteCity, JobSiteState JobSiteZip, ScheduleStartDate, ScheduleEndDate, ActualStartDate, ActualDoneDate, ManagementFee)

The “State” and “JobSiteState” fields hold standard two-letter abbreviations like “NJ”, “NY”, and “TX”. Complete the grids on the query grid sheet to implement the following queries.

- If a query does not use the “Total” row, cross it out. Otherwise, each of its cells should contain “Group by”, “Where”, or an aggregation operator such as “Sum” or “Avg”.
- Each query should show only the requested information, with columns in the order requested.
- For each column used in a query, remember to put a check in the “Show” box whenever necessary.

(a) Find all cases in which a vendor described as a “plumber” has charged an amount exceeding their contract estimate by more than 20%. For each such case, show the vendor name, project name, estimate amount, and amount actually charged.

(b) Show the name, total estimated cost, and total actual cost of each project completed on or before April 30, 2006. List in order of estimated cost, starting with the highest and ending with the lowest. The *ManagementFee* amount in the PROJECT table should *not* be considered part of the total estimated or actual cost.

(c) For each vendor with description “plumber” or “HVAC”, list their name, vendor type description, total number of contracts, and average actual cost of each contract.

(d) Find all cases where an “electrician” vendor is from a different state than the job site they are working on. Show the vendor name, vendor state, project description, and job site state. List in order of job site state.

(e) For each vendor, show its name and the number of its contracts for job sites in New Jersey that were completed late or over budget. If there are no such contracts, the vendor need not be listed.