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# Teaching Management Information Systems as a General Education Requirement (GER) Capstone

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## Abstract

Although many IS programs nationwide use capstone courses in the major, this paper reports on the use of an upper division Management Information Systems (MIS) class as a general education requirements (GER) capstone. The class is a core requirement for all majors in the Bachelor of Business Administration (BBA) program at the University of Alaska Anchorage, which includes the MIS major. The BBA program is accredited by the Association to Advance Collegiate Schools of Business (AACSB).

The explosive developments in information technology have both economic and cultural impacts on society, and often lead to ongoing debates. In dealing with the impact of technology on society, the capstone class challenges students to integrate GER knowledge, business and their major-specific knowledge, and IT knowledge. Students must demonstrate skills across five dimensions: 1) knowledge integration, 2) effective communication (oral and in writing), 3) critical thinking and problem solving, 4) information literacy, and 5) quantitative perspectives. The five GER dimensions are assessed using a research project and a series of four hands-on projects (information literacy, database management, data mining, and decision support). The research project is based around a debate on topics relating to the impact of technology on society, and challenges students across all five dimensions. The hands-on projects focus more on information literacy, critical thinking and quantitative perspectives.

Assessment data collected over the past five years (spring 2007 to spring 2011) show that a majority of students (75% or more in recent years) consistently achieve passing scores across the five GER dimensions.

**Keywords:** general education requirement, capstone, management information systems, assessment

## 1. INTRODUCTION

Management Information Systems programs nationwide often include a discipline capstone course, focused on e-commerce (Abrahams & Singh, 2010), systems development (McGann & Canili, 2005) or emerging technologies (Janicki, Fischetti, & Burns, 2007) – and emphasizing soft skills (communication, interviewing, and client interaction). Instead, this paper reports on the

use of an upper division MIS course as a general education requirement (GER) capstone.

A number of colleges and universities require GER capstone courses, mainly to give students an integrative experience, but also to facilitate assessment (Rowles, Koch, Hundley, & Hamilton, 2004). Such capstone courses are intended to help students integrate better across the seemingly disparate courses they took to fulfill their GER. Additionally, because GER

capstone classes rely on knowledge students acquired in their general education classes, assessments in a GER capstone class can evaluate the overall impact of general education courses on students (Wilson, et al., 2008).

Unlike discipline-specific learning, student learning in the general education classes is difficult to assess. Students have a choice of classes to meet GER, and they often transfer coursework from other institutions. Also, some of the GER skills are taught in multiple disciplines, with different approaches, expectations and outcomes (for example, critical thinking does not mean the same thing in philosophy and in sociology) (Bers, 2000). While standardized tests or exit interviews can be used to assess GER, using papers in a capstone class appears to be a particularly good means in terms of: student motivation, costs of the instrument, and the ability to reflect both quantitative and qualitative aspects of the learning (Bers, 2000).

GER capstone classes have been used for many decades at some institutions. A survey of 707 institutions showed that 549 of them offered one or more capstone course, but most of these were discipline capstones, taught by a single faculty member in the discipline (Henscheid, Breitmeyer, & Mercer, 2000). The survey also uncovered the need for a more comprehensive assessment of the capstone classes.

More recently, assessment has taken center stage. Nancy Fernandez describes the assessment-focused culture at CalState Pomona and how the process has resulted in changes that improved student learning (Fernandez, 2006). The Pomona model involves an Integrative General Education Program culminating in a capstone course. Portland State developed their capstone model in 1994 (Kerrigan & Jhaj, 2007). Their assessment involves three types of feedback: a mid-quarter qualitative feedback session led by a trained facilitator in class; a quantitative student evaluation at the end of the term; and a qualitative survey of students' perception of their learning, also at the end of the term. Southeast Missouri State University assesses students both at the beginning and at the completion of their studies, including longitudinal and across sections comparisons (Blattner & Frazier, 2004).

Many GER capstone courses must satisfy multiple sets of requirements: departmental requirements (because the capstones are usually housed in an academic department), university wide requirements (applicable to all GER capstone courses at a given institution), and requirements from external accreditation agencies (Claus & Hawkins, 2007). Most if not all GER capstone courses tend to include some form of information literacy (ability to locate and evaluate information), communication, and critical thinking skills. The assessment tools used in the courses include research papers (with an oral presentation component) or portfolios (Brock, 2004).

This paper describes goals and achievements of a GER capstone class built around the Management Information Systems class at the University of Alaska Anchorage, in the College of Business and Public Policy. The class is a core required class for all non-accounting majors in the Bachelor of Business Administration program. Since the class became a GER capstone, accounting majors are often taking it to satisfy GER requirements.

First taught as a GER capstone in fall 2006, the class has been successful in achieving the intended goals. Assessment is built into the curriculum, and it is based on student artifacts that document student performance across a series of five GER capstone required areas (described below). Part of the assessment data is used for AACSB accreditation assessment in the College, but the data collected encompass a more extensive set than required for accreditation. Data collected over the past five years indicate that a majority of students perform well across the five GER dimensions.

The paper first introduces the GER capstone requirements at UAA and describes the curriculum development process (Section 2). Section 3 describes how the MIS class fulfills the GER capstone requirements. In Section 4, we present assessment data collected over the past five years, and we discuss student feedback and future plans. We present conclusions in Section 5.

## **2. GER CAPSTONE REQUIREMENTS AT THE UNIVERSITY OF ALASKA ANCHORAGE**

University of Alaska Anchorage (UAA) is part of the State of Alaska public university system. UAA is the largest independently accredited

university in the state, and it is located in the largest population center. Anchorage is home to almost half of the 650,000 citizens of the state, and is the main hub for transportation, oil and gas, and health care industries. UAA celebrated its 50<sup>th</sup> anniversary in 2004 and offers close to 200 degrees and programs ranging from certificates to (joint) doctoral degrees. There are 20,000 students enrolled in one or more courses either at the main campus or at one of the six community campuses in Southcentral Alaska.

UAA is an open admission university, enrolling many first generation college students. About a third of the students are minorities, many Alaska Natives from villages across the state. A large number of students are pursuing a second career, and many are in the military, taking classes at UAA during a limited time of deployment in Alaska. Many students transfer to UAA from other colleges in or outside the state, and many transfer from UAA to complete their degrees elsewhere. UAA is regionally accredited by the Northwest Commission on Colleges and Universities (NWCCU).

Curriculum development at UAA is controlled by faculty. Undergraduate courses are initiated by faculty members in the departments, and are then vetted by curriculum committees in the colleges. The Undergraduate Academic Board (UAB) reviews and approves undergraduate curriculum, while the Graduate Academic Board handles graduate courses and programs. Ultimately, the Faculty Senate approves all new courses and programs, as well as changes to existing ones.

A subcommittee of the UAB is in charge of pre-screening GER courses, before they are submitted to the UAB. In late 1990's, the subcommittee started working on revising the GER framework at UAA, partly in response to requirements from the regional accreditation body, the NWCCU. The Faculty Senate passed a motion in late 2002 that a GER integrative component be built into the new GER framework. In response to this motion, in March 2004, the UAB subcommittee submitted a proposal to require a GER capstone for all four year programs at UAA. The proposal was approved in early 2005, and the subcommittee made available grants for faculty to develop GER capstone classes.

The development of the GER capstone framework was guided by four considerations.

First and foremost was the goal of providing an integrative experience to students. Second, while the GER were not programmatic in nature, the capstone lent a programmatic nature to the GER coursework. Third, the revision was not to increase the credit requirements for degrees. Finally, the capstone was intended to provide assessment data for GER for accreditation.

Before students can register for a GER capstone class, they must complete their Tier 1 GER (basic skills) and the Tier 2 (disciplinary distribution areas). Serving as a culminating point, GER capstone classes must satisfy at least four of the five capstone requirements, and at least three of the four must be specifically addressed by the course outcomes assessment. The five capstone requirements are: 1) knowledge integration, 2) effective communication, 3) critical thinking and problem solving, 4) information literacy, and 5) quantitative perspectives. Such requirements are common among capstone models, particularly those of information literacy, communication and critical thinking, for example Portland State (Kerrigan & Jhaj, 2007), Southeast Missouri State University (Blattner & Frazier, 2004).

Faced with the challenge of developing a GER capstone course, academic programs often choose to expand the scope of existing discipline specific capstone courses to incorporate additional requirements towards GER integration, although they may also create new integrative courses (Hawthorne, Kelsch, & Steen, 2010). Adapting existing courses is a key mechanism for introducing GER capstones without increasing the credit requirements for degrees. By simply broadening the instructional goals for the class to meet capstone requirements, a discipline capstone class can serve a dual purpose. Some capstone experiences are for a homogenous group of majors: "magnets" that demand mastery of the core of the discipline, while other capstone courses are interdisciplinary or multidisciplinary in content and are places where diverse groups of students arrive to a common "mountaintop," in the terminology in (Rowles, Koch, Hundley, & Hamilton, 2004). The course described in this paper is a "mountaintop," a College wide capstone, as opposed to the departmental MIS Senior Projects capstone class (the "magnet").

**3. CIS 376 – MANAGEMENT INFORMATION SYSTEMS AS A GER CAPSTONE**

Business administration is one of the five most popular majors at UAA. Consistent with university policies, the College of Business and Public Policy programs has an open admission policy, but students must satisfy GPA requirements to move up to upper division (taking classes at and above the 300 level). Several programs in the College (including the BBA) are AACSB accredited. Outcomes assessment is a key component of AACSB accreditation, and is based to a large extent on data collected in the core courses (required for a majority of the students in the College).

CIS 376, Management Information Systems, was already one of the core courses in the Bachelors of Business Administration program at UAA in 2006. The class was required of all BBA majors, except for accounting majors who were required to take an Accounting Information Systems class. There are three sections of 25-35 students offered in any given semester, and the class is offered every year in both fall and spring, and occasionally in summer.

Faculty in the Computer Information Systems department realized the opportunity they were facing. CIS 376 was a good candidate for the first GER capstone class in the College of Business and Public Policy, before discipline specific capstone classes could be developed. Because the class was already required of most majors in the college, it could accomplish the GER integration goals without requiring additional credits to complete the degree. Taking advantage of one of the curriculum development grants, faculty modified the class over the summer of 2005 to meet the GER capstone requirements. The revised CIS 376 received Faculty Senate approval in spring 2006 and was effective for fall 2006.

The redesigned course is intended to be accessible for the non-MIS majors, while still challenging for MIS majors. Students are encouraged to cooperate on projects, but must submit individual work on assignments. They are free to share ideas and solutions at the concept level, as long as they put the concepts in practice on their own. Faculty have an open door policy, and help students overcome roadblocks, guiding them through the projects without actually pointing the way.

CIS 376 is at the core a typical introduction to MIS class. Topics include basic information systems components (hardware, software, databases, data networks concepts) as well as the development, acquisition and use of specific functional or cross-functional information systems. There are two exams, based on short answer essay questions and brief case studies. Weekly multiple choice quizzes about the theory concepts are delivered and graded online, and students can retake any quiz (with a different set of questions) until they master the material.

Many MIS theory concepts lend themselves to supporting knowledge integration (for example Moore’s Law relates via economics concepts to the growth of the internet). The GER capstone requirements are fulfilled by a set of assignments designed around this core of MIS theory. Two types of assignments are particularly relevant: a research project on current issues related to MIS, and a series of hands-on projects where students apply theory to solving business problems. The mapping from the course assessment tools to the five GER capstone requirements is outlined in Table 1 below.

Assessment tool	KI	COM	CT	IL	QP
Exams (2)	√				
Weekly quiz	√		√		
Hands-on projects					
#1			√	√	
#2			√		√
#3	√		√		√
#4	√		√		√
Research projects					
Debate	√	√	√	√	
Website	√	√		√	
Paper	√	√	√	√	√

Table 1. Outcomes assessment mapping (KI - knowledge integration, COM - communication, CT - critical thinking, IL - information literacy and QP – quantitative perspectives.

The rest of this section outlines the essential features of the hands-on projects and the research project, focusing on how they uniquely highlight the students’ achievements of the five GER capstone requirements. An example of each type of hands-on project is included in the Appendices.

### **Hands-on projects**

There are four hands-on projects during the semester, spaced 2-3 weeks apart and closely related to lecture topics, challenging students to apply concepts and to demonstrate skills working independently. Each assignment is a set of 10-12 multiple choice or multiple answer questions, using an open time and open book format. Each of the four hands on assignments is worth 5% of the final grade. Because of the test format, the hands on assignments are scored automatically online, which allows students to receive immediate feedback on their work.

#### i). Information literacy project

The first project is designed to be relatively easy, to encourage students and to familiarize them with the format of the hands-on tests. The project is about assessing the credibility of an online business, using a variety of tools (domain registration data, Better Business Bureau data, online forums, analysis of published company policies, etc). A sample test is included in Appendix 1.

#### ii) Database project

The second hands-on project is due after the completion of the chapter on database management. Students are given a scenario or a large data set (10,000 records) in a flat file and are asked questions about organizing the data in a relational database. For non-MIS majors with only a rudimentary understanding of database concepts, this is a very difficult project. In fact, students find this the most challenging of the four hands-on projects, which is also reflected in the lower scores. Along with the other aspects of the course, this hands-on project has also been modified over the years to address the low scores. Because database concepts are so difficult for non-MIS majors, the only workaround has been to offer a make-up test, with a different scenario, which generally leads to much improved test scores. Revisiting database concepts in hands-on 3 (below) is another way to ensure that students get a better understanding of the topic. A sample test is included in Appendix 2.

#### iii) Data mining project

The third hands-on project is due after the completion of the chapter on business intelligence. The lectures cover several tools,

including online analytical processing, RFM (recency, frequency and monetary) analysis and market basket analysis, and this project is a rather straightforward application of the techniques.

As part of the data processing, students may need to revisit database concepts yet again. For example, they may need to normalize a flat file to be able to conduct some of the more complex queries. If the data set includes records of transactions with multiple products, normalization may be required to calculate the number of transactions for a given sales person. Although the same goal could be accomplished with simple SQL statements, the students are not MIS majors and have not had sufficient background to carry out such tasks. The assignment does not require a particular approach, and students are free to use SQL, but most students find it easier to normalize the database (a process they have learned about) and then use pivot charts on the normalized database tables.

Having had additional exposure to database concepts by this point, as well as theoretical exposure to the data mining techniques, students typically do well on this project. An in-class workshop gives students some general guidelines and an opportunity to ask questions, especially about the database concepts. Feedback from graduates is that the skills learned in this project are directly applicable in many business jobs. A sample test is in Appendix 3.

#### iv) Forecasting and decisions support project

The last hands-on project is typically due at the very end of the semester, and is less connected with the lecture. Instead, it is a diverse set of questions with direct relevance for making business decisions. The first part of the project deals with forecasting, with a number of scenarios of increasing difficulty and having to do with break even analysis. Progressively, students must calculate the growth rate that will keep a company from running out of cash, then with a cash reserve, and finally with a cash reserve even in the presence of inflation. A second component of the project is an optimization problem, using the Microsoft Excel package Solver. A final component is a rudimentary decision support system for choosing among a set of health insurance plans. Many students have not yet had to make choices

of this nature, and are not familiar with deductibles and out of pocket payments. Although many of the concepts tested in this assignment are not covered in the lecture, an in-class workshop gives students the opportunity to ask clarification questions and provides a general overview of the problem. A sample test is in Appendix 4.

Together, the four hands-on projects test students on four of the five areas of the GER capstone: knowledge integration, critical thinking and problem solving, information literacy, and quantitative perspectives. These projects are highly structured in the types of questions students are asked to solve, and cannot be used to assess the communication skills. In contrast, the research projects are open ended and manage to assess all of the five areas, including communications.

#### Research project on current issues in MIS

The research project has three separate components: an oral presentation (using a debate format), a website (which is also used as the presentation tool for the debate) and a formal research paper. The research project counts for 25% of the final grade, with 13% for the paper, 5% for the website and the remainder for the oral debate.

The topics for the research papers change regularly to reflect current topics in MIS. Topics include secondary uses of data, employee monitoring, using Facebook for screening potential hires, and mandating subsidies for broadband access.

Students choose their own topics from the list, sometimes expecting that there is a "right answer" to the debate. They soon realize that there are no definitive answers to the debate question - and are horrified to learn that they might have to defend the side of the debate they do not agree with. For the oral debate, students must prepare both sides. The side they actually get to defend is decided by a coin toss, right before the actual debate.

Students work in pairs on their research question. They can share sources and exchange ideas, but must prepare websites and write research papers independently. Moreover, the oral debate pits the two students against each other in front of the class. As mentioned above, students must prepare both sides of the debate and they end up debating one side as decided by

a coin toss. The website must include rich multimedia and must be suitable for presentation in front of a medium size audience (25-35), but it must also be structured to allow for self-paced browsing, guiding the reader and providing sufficient information for somebody who has not seen the oral debate.

The research paper must include a balance of arguments on both sides of the issue, followed by a critical analysis and a personal position point, written in the first person. Throughout the research project, students must choose strong arguments and must provide evidence from reputable sources. Papers are rather extensive, 2500-3500 words, and are graded using strict standards for presentation, formatting and contents.

To research the topics, students must demonstrate information literacy. Formulating arguments requires critical thinking and at times quantitative skills. The three components of this project (oral debate, website and paper) make it a heavily communications based assignment. As such, the research paper is uniquely able to assess all five areas of the GER capstone requirements - but it requires considerable efforts both on the part of the students, for research and writing, and on the part of the instructor, for grading.

#### 4. DISCUSSION

CIS 376 has been taught as a GER capstone class since fall 2006, but the assessment tools have evolved. Since spring 2007, the number and nature of the assessment tools have been unchanged, allowing a longitudinal comparison of student achievement levels.

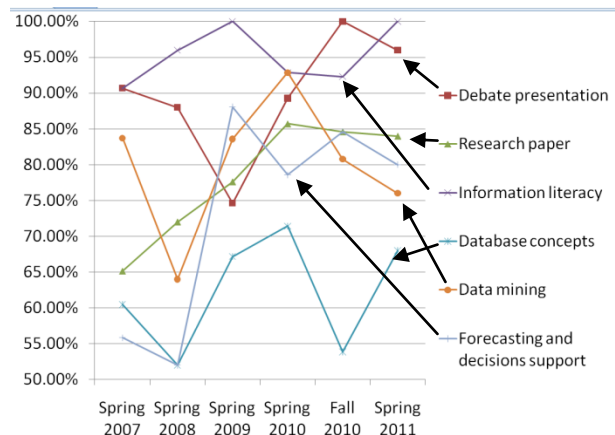


Fig. 1. A majority of students achieve passing

scores across the entire spectrum of assessment instruments. The lowest curve is for Hands-on #2: Database concepts.

The assessment data above (Fig. 1) shows the percentage of students who achieve a passing grade (70% or higher) on each type of assessment. Because tools test various types of skills, it is possible to infer the overall skill levels of the students across the GER capstone areas. Numerical data are included in the table in Appendix 5.

Over the course of the five years, a majority of the students (75% or better within the last three years) achieve passing scores on all of the assignments (except for the Hands-on 2 on database management, which is rather technical, and which is not part of the GER capstone outcomes). There is a slight trend up in the scores, although the volatility of the scores and the relatively low number of data points does not lend statistical significance to this trend.

## 5. CONCLUSIONS

CIS 376 is a core MIS class required for non-accounting business majors in the College of Business and Public Policy at the University of Alaska Anchorage. The class was converted to a GER capstone format, by ensuring that assessment tools track student performance across five dimensions: 1) knowledge integration, 2) effective communication, 3) critical thinking and problem solving, 4) information literacy, and 5) quantitative perspectives. Although the class is not required for accounting majors, many choose to take it as their GER capstone. Assessment data collected over the past five years indicate that a majority of students achieve passing scores (70% or better) across the five dimensions. Within the last three years, 75% of students achieved passing scores on the five GER dimensions.

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## Appendix 1. Hands-on project #1: Information Literacy

1. According to the [www.sellyourmiles.com](http://www.sellyourmiles.com) web site, the physical address for the company is in
  - a. Alaska
  - b. California
  - c. Florida
  - d. New York
  - e. No address is given
  
2. According to WHOIS information, the registrant for the [www.sellyourmiles.com](http://www.sellyourmiles.com) web site is
  - a. John Allen
  - b. Martin Ferrari
  - c. Donna Wilson
  - d. Gabriel Wilson
  - e. Sell Your Miles, Inc.
  
3. Search the web site and locate a contact email address. You may be surprised that the address is not [something@sellyourmiles.com](mailto:something@sellyourmiles.com), but something different, which will point you towards a different web site. You may verify that the registrant for this second web site is the same as for [www.sellyourmiles.com](http://www.sellyourmiles.com). On this second company web site, locate the Certificate of Registration from the State government. On the certificate, locate the official company name:
  - a. World Wide Travel
  - b. World Wide Travel, Inc.
  - c. World Wide Travel Services
  - d. WWT Consulting
  - e. WWT, Inc.
  
4. Do a Google search for BBB and the state where the registrant of the two web sites is located. On the list of Google results, locate the BBB office that services the city where the registrant is located. At that web site, do a search for the company name you found in #3 above. The company ID on the BBB site is:
  - a. 13042635
  - b. 40000104
  - c. 13058553
  - d. 13074883
  - e. 13142441
  
5. According to the BBB site, the company has had a BBB record since
  - a. 2/1/2000
  - b. 10/20/2000
  - c. 4/24/2006
  - d. 4/12/1975
  - e. No date is available
  
5. The company rating on the BBB site above is
  - a. A
  - b. B
  - c. C
  - d. D
  - e. F
  
6. According to the BBB web site, this company rating is
  - a. An exemplary rating. This means that nothing in our files causes us to have any doubt about the company's reliability.
  - b. An excellent rating. A company with this rating may not rate higher because of a greater number of rate-lowering factors, but we do not consider them to be factors that would likely adversely affect consumer transactions.
  - c. A very high rating. A company with this rating would not have a significant number of complaints or other considerations that could pose a problem to consumers.
  - d. A good rating that still implies reputability. The rating may relate to length of time in business, a past problem that's been corrected, or something else that does not cause problems for consumers. We believe a company with this rating would generally conduct business and respond to any complaints satisfactorily.
  - e. We strongly question the company's reliability for reasons such as that they have failed to respond to complaints, their advertising is grossly misleading, they are not in compliance with the law's licensing or registration requirements, their complaints contain especially serious allegations, or the company's industry is known for its fraudulent business practices.
  
7. Search now on the BBB web site for the business associated with the website [www.sellyourmiles.com](http://www.sellyourmiles.com) (you might need to try different search types to make sure you are using the correct name). According to the web site
  - a. The business is listed and has a better rating than the company you searched for in #4.
  - b. The business is listed and has the same rating as the company you searched for in #4.
  - c. The business is listed and has a lower rating than the company you searched for in #4.
  - d. The business is listed, but not rated.
  - e. The business is not listed.

8. According to the [www.sellyourmiles.com](http://www.sellyourmiles.com) web site, selling miles is

- a. Legal in all 50 states
- b. Legal in most of the US states
- c. Legal in few of the US states
- d. Legal in only one state
- e. Illegal

9. Do an internet search and read about the legality of selling miles, then answer the following:

- a. Selling miles is prohibited by federal laws
- b. Selling miles is prohibited by state laws in most states
- c. Selling miles is legal, but not in as many states as the site advertises

- d. Selling miles is legal in most US states, but prohibited by other means
- e. Selling miles is legal and a totally legitimate transaction

10. Based on your findings so far, a reputable business in need of travel arrangements should

- a. Use this site with confidence, any time
- b. Use the site only for domestic (US) travel
- c. Use the site only to travel to and from states where the service is legal
- d. Use a similar service, but from a more reputable business with a higher BBB rating
- e. Avoid using the services as well as the web site

## Appendix 2. Hands-on project #2: Database Management

The second hands-on project deals with database design.

You are managing a small school for airline pilots and you need to keep track of aircraft airtime (for maintenance schedules) and pilot flight hours (for certification). For simplicity of the problem, each aircraft can only accommodate exactly one pilot (but cannot fly without a pilot). All pilots are certified to fly on any of the aircraft you have. You are designing a database to manage this data.

Start by laying out an E-R diagram based on the requirements above. Then answer the questions below.

1. Which of the following should be tables in the database? (check all that apply)

- a. Pilots
- b. Aircraft
- c. Total aircraft airtime
- d. Flight durations
- e. Flights

2. Which of the following would be an appropriate primary key for the Pilots table? (check all that apply)

- a. First name
- b. Last name, First name
- c. Weight
- d. SSN
- e. Flight time

3. Which of the following would be an appropriate primary key for the Aircraft table? (check all that apply)

- a. Aircraft type (model)
- b. The combination of aircraft model and serial number
- c. Aircraft weight
- d. Aircraft owner
- e. Automatically generated unique key

4. What is the most appropriate relationship between pilots and flights (think about actual facts, not about database tables)?

- a. One to one
- b. One pilot to many flights
- c. One flight to many pilots
- d. Many pilots to many flights
- e. There is no relationship

5. How would you accomplish the relationship in #4 above?

a. Use a foreign key in the Pilots table. The foreign key is the primary key of the Flights table.

b. Use a foreign key in the Flights table. The foreign key is the primary key of the Pilots table.

c. No need to do anything, because there is no relationship.

d. Use an intersection table between Pilots and Flights.

e. Pilots and Flights go in the same table, because this is a one-one relationship.

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6. What is the most appropriate relationship between pilots and aircraft (think about actual facts, not about database tables)?
- One to one, because there can be only one pilot per aircraft
  - One pilot to many aircraft (one pilot will fly on many aircraft, in turn)
  - One aircraft to many pilots (many pilots will fly on any one aircraft, in turn)
  - Many pilots to many aircraft (many pilots, each one will fly on many aircraft)
  - There is no relationship
7. How would you accomplish the relationship in #6 above?
- Use a foreign key in the Pilots table. The foreign key is the primary key of the Aircraft table.
  - Use a foreign key in the Aircraft table. The foreign key is the primary key of the Pilots table.
  - No need to do anything, because there is no relationship.
  - Use an intersection table between Pilots and Aircraft.
  - Pilots and Aircraft go in the same table, because this is a one-one relationship.
8. Which of the following fields can be part of the Pilots table? (check all that apply)
- Pilot name
  - Flight duration
  - Aircraft ID for the flight
  - Pilot age
  - Pilot weight
9. What is the best way to track pilot flight time (the total number of hours a pilot has flown)?
- Use a field in the Pilots table, and update this field after each flight
  - Use a field in the Flights table, and set up a query to calculate total time
  - Use a field in the Flights table and update this after each flight
  - Use a field in the intersection table of Pilots and Flights
  - Set up a separate table with the Pilot Flight Time
10. You change your mind about the requirements, and decide that you need to accommodate multiple pilots per aircraft in your database design. In fact you discover that the number of pilots could be very high – a whole group might take off at the same time on one plane, and take turns piloting while up in the air. What changes do you need to make to accommodate this?
- Easy, you do not need to make any changes to accommodate multiple pilots.
  - You need to add another field in the Flights table.
  - You need to add another field in the Pilots table.
  - You need to add one or more tables.
  - You cannot accommodate such a request, no matter what you do.

### Appendix 3. Hands-on project #3: Data Mining

The third hands-on project deals with data mining. You will need to process data into information that might be useful in making business decisions.

The file "Spring 2009.txt" contains data about purchase transactions for a small Alaskan company. The fields are separated by tabs, and contain in order, the transaction year, month and day, then ID of the salesperson who made the sale, the ID of the customer who made the purchase, the ID of the transaction, the product ID and the sales price. The questions below involve either revenues generated (the sum of the sales prices) or volumes sold.

This packet includes two files (see below):

"Spring 2009.txt" is the data set

"Data mining hands-on.ppt" is a file with directions on setting up your queries

In answering the questions, you might find it useful to import the data in a database, and to run some queries to help you get to the answers. You might also need to use a spreadsheet to process the results from the database queries, although you can also do that with a hand calculator. In getting answers to most of the questions, you might find using pivot tables or pivot charts as helpful.

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You are not required to submit any of the files you used, but only to answer the questions. As with previous hands-on projects, you can only submit the answers one time. Answers are omitted for some questions, to save space; the numerical answers include a list of ten randomly generated possible answers, to reduce the chance of a random guess.

1. What type of relationship is there between sales persons and customers, based on the data in the file?
  - a. 1:1
  - b. 1:N
  - c. N:M
  - d. Cannot specify based on the data in the file
  - e. It depends on the user's point of view
2. Which customer generated the highest total revenue over the entire transactions window?
  - a. Customer 31
  - b. Customer 32
  - c. Customer 33
  - d. Customer 34
  - e. Customer 35
3. What is the value of the highest average revenues per transaction among all customers?
4. Which customer is closest to a 513 in the RFM analysis?
5. Which sales person should be encouraged to share best practices with the others?
6. Which is the best month of the year in terms of total revenues?
7. What is the support value for the two products that are the best candidates for bundling (and should be marketed together)?
8. What is the lowest support value, for the two products that are most likely to be substitutes for each other?
9. What is the best selling product (highest volume)?
10. For individual customer-salesperson relationships, what is the largest number of items any customer purchased from any one salesperson?

## **Appendix 4. Hands-on project #4: Decision Support**

CIS 376 – Management Information Systems  
Hands-on project -- part 4

The fourth hands-on project deals with business forecasting and decisions support systems. You are encouraged to create a spreadsheet to answer the questions below. You do not need to submit the spreadsheet.

It is December 2010. You are planning to start a small airline in bush Alaska. The grand opening is January 2011.

You have \$250,000 startup capital. You have fixed payments to make for your airplanes, staff and office space, at \$80,000 per month. Your variable costs are \$120 per passenger and you charge an average of \$180 per passenger.

You expect to have 800 passengers in January 2011 and you expect a uniform rate of increase in this number, some X % month to month. Set up a spreadsheet so that you can calculate your cash balance at the start and end of each month, given the number of passengers for that month. Link your cells to allow you to specify the month to month growth rate X% in a single cell.

Answers are omitted for some questions, to save space; the numerical answers include a list of ten randomly generated possible answers, to reduce the chance of a random guess.

1. In any given month, how many passengers do you need to be profitable? (to make enough money during that month just to cover your expenses for the month)

2. If you start with 800 passengers in January and the growth rate  $X$  is zero (no growth), what is the first month at the end of which you will have a negative cash balance?

3. Calculate the smallest rate of increase in the number of passengers per month  $X$ , to make sure you do not run out of cash at any time (you always end up with some cash left at the end of each month). You might want to use goal seek (try various starting values for  $X$  to help goal seek to converge).

4. Calculate the rate of increase in the number of passengers per month  $X$  if each month you must maintain a cash reserve (at the end of the month) of at least 10% of the current month's expenses.

5. Redo the previous question if the inflation rate is at 1% per month (assume that all your expenses increase 1% per month).

6. Faced with high demand on one of your routes, you charter a larger airplane for a one-time flight. You are able to sell first class tickets at \$1200 per person (but will only be able to sell at most 10 tickets), economy tickets at \$400 per person or you can carry cargo for \$1.20/lb.

Each first class passenger comes with 600 lbs of weight (luggage, passenger and in-flight meals) and each economy passenger weighs in at 300 lbs (including luggage, passenger and in-flight meals). According to FAA specifications, the aircraft can carry no more than 25,000 lbs, including both passengers and the cargo weight.

Additionally, you need to figure out space limitations on board. Each first class seat takes 30 sq. ft. of space and each economy seat takes 13 sq. ft. You can pile up cargo 50 lbs/sq. ft. The total floor space in the plane is 1000 sq. ft., which needs to accommodate all the passengers and the cargo. For simplicity, you do not need to have full rows of seats (i.e., you could have 17 seats on the whole plane) and do not need to worry about aisle space.

Use solver to figure out how many passengers and how much cargo you can carry to maximize your revenue for the flight. Make sure you consider all the conditions you need for solver. The program does not understand the realities of life :).

How many pounds of cargo will you need to carry to achieve this maximum?

7. You also need to purchase insurance for your employees. The three options available are given in the following table.

Plan A: Monthly charge: \$30, Deductible \$1300, Out of pocket maximum \$5000

Plan B: Monthly charge: \$60, Deductible \$500, Out of pocket maximum \$2000

Plan C: Monthly charge: \$150, Deductible \$200, Out of pocket maximum \$750

Employees may elect to participate in any one of the three plans, or to opt out of insurance totally. Employees who select a health plan pay the monthly charges for all the twelve months per year; no fractions of a year are allowed.

We use the term "medical care expenses" for the amount billed by the medical providers. This amount is paid in part by the patient, with the balance covered by the insurance. "Patient costs" are the charges incurred by the patient (which include monthly charges and the patient's portion to the medical providers' bill).

As employees incur medical expenses, they pay for part of the medical care and the insurance pays for the balance. Given a certain cost of medical care expenses, the relative share of the employee and the insurance company are as described below. The employee must pay for the full cost of the medical care until the expenses exceed the Deductible. For the medical care expenses in excess of the Deductible, the plan pays for 80% of the expenses, and the employees are responsible for the remaining 20%. Finally, once the expense incurred by the employee reaches the Out of Pocket, the plan pays for 100% of the medical charges. The Out of Pocket charge does not include the Monthly Charges, nor the Deductible. Both the deductible and the out of pocket amounts are for the year; at the end of the year, the patient needs to start over and meet the deductible and out of pocket anew.

If the employee selects Plan B, what is the maximum amount of patient costs they will spend on health care by the end of the year (including Monthly Charges and their portion of the medical care, not covered by insurance)?

8. How much do the medical care expenses need to be (at least) for the employee to have to pay the maximum figure, as in the question above?

9. At what cost of medical care is the employee paying the same amount whether using insurance (the lowest cost plan) or paying for medical care entirely on her own? You might want to use goal seek for this question.

10. An employee expected the cost of medical care for the following year to be \$7,000. Based

on this assumption, the employee chose the plan with the lowest expenses for that level of medical care. If the actual expenses are in fact \$9,000 at the end of the year, this choice of plan might not be the best anymore. How much worse off is the employee because of the error in estimating medical expenses? (what is the difference between what the employee would have paid under the best plan and what she is actually paying in the scenario above?)

### Appendix 5. Assessment data 2007-2011

Semester	Enrollment	Debate presentation	Research paper	Hands-on #1: Information literacy	Hands-on #2: Database concepts	Hands-on #3: Data mining	Hands-on #4: Decision support
Spring 2007	43	90.70%	65.12%	90.70%	60.47%	83.72%	55.81%
Spring 2008	25	88.00%	72.00%	96.00%	52.00%	64.00%	52.00%
Spring 2009	67	74.63%	77.61%	100.00%	67.16%	83.58%	88.06%
Spring 2010	28	89.29%	85.71%	92.86%	71.43%	92.86%	78.57%
Fall 2010	26	100.00%	84.62%	92.31%	53.85%	80.77%	84.62%
Spring 2011	25	96.00%	84.00%	100.00%	68.00%	76.00%	80.00%

Table A.5. Assessment data for all five years CIS 376 was taught as a GER capstone with a consistent set of assessment tools. The numbers indicate the percentage of students in who achieved 70% or better on each assessment tool.