1.264 Final Exam
Fall, 2000

Exam guidelines:

1. Three hours are allowed to complete the exam.
2. If there are questions or clarifications, ask the proctor.
3. 10 pages of notes (double sided) are allowed.
4. Write your answers in the examination booklet provided.
5. Questions 1, 4 and 5 are short answers, limited to a maximum of 2-4 sentences or phrases. Two sentences or phrases are completely adequate to answer any of these questions; 4 sentences are not necessary. Demonstrate that you understand the principles and key points. You will receive full credit for an answer if you make the principal observation(s) that the question is asking for. Details are not necessary.
6. No laptop computers are allowed. Calculators are not necessary and are not allowed.
7. 100 points total (generally 20 points for each of 5 questions).
8. Put your name and email address on the exam booklet.

1. Software process. (20 points)

The sales staff at MIT Aircraft Parts was demanding an upgrade to AircraftParts 1.0, which had been built by the 1.264 class in fall, 2000. This business (with its associated software) had been incorporated and launched by MIT as a fundraising means. MIT accidentally failed to pay its phone bill in December 2000; the phones were disconnected and the annual telephone fundraising appeal was disrupted, leaving MIT short of funds. MIT therefore decided to launch this business to make up for the lost revenue.

The upgrade was needed to correct defects (bugs) and some annoying user interface glitches, such as a clumsy, multi-page order entry process and the need to search many forms in the Visual Basic application to locate suppliers, parts and prices. The Web site, while functional, had similar problems. Pat and two developers were brought in to patch together ways to update the database when orders were placed, and to complete additional forms and Web pages to create a minimally functional Windows app and Web site, but that was all that was possible before the aircraft parts business was launched in early January, 2001.

After this short-term effort, Pat was then kept on as the project manager by MIT to correct the problems that the sales staff was reporting. Pat met a consultant, Attila, at an MIT seminar, who he then brought in for advice. Attila said, "You need to make the requested changes as quickly as possible, so you need to organize your project for all-out development speed. Prototyping is the fastest development method, so have your team use that." Pat thought that sounded good, so when he met with the team (two developers) later that day, he told them to use prototyping.

Mike was the more senior of the developers and he was surprised. "Pat, I don't get it," he said. "We've got a few weeks at most to fix a bunch of bugs and make some modest changes to the user interface. What do we need a prototype for?"

"We need a prototype to make sure we finish the project quickly," Pat said. "Prototyping is the fastest approach. Do you have some kind of problem with that?"

Touchy subject, Mike thought. "OK," he said, "we'll build a prototype, if that's what you want. Mike and the other developer, Sue, went to work on the prototype. Since it was almost identical to the current system, it only took a few days to mock up.

At the beginning of week 2, they showed the prototype to the sales staff manager, Al. "Rowrbazzle! I can't tell the sales staff that's all they're getting! It hardly does more than the current piece of junk. The staff is waiting for something better. I've got some ideas for some new functions. Here, I'll show you." Mike and Sue listened patiently and after the meeting Mike got together with Pat.

"We showed Al the prototype. He wants to add some new features, and he won't take no for an answer. But we have our hands full with the work we're already supposed to be doing."

"I don't see the problem," Pat said. "He's the sales staff manager. If he says they need new functions, they need new functions. You will just have to find a way to get them done."

"I'll try," Mike said, "But I have to tell you there is only about a 1 percent chance we'll finish in the next few weeks if we add these features."

"Well, you've got to do them," Pat said. "Besides, now that you're using prototyping, the work will go faster."

Two days later, Al stopped by Mike's cubicle. "I've been looking at that prototype and I think we need to redesign the parts inventory and carrier user interfaces; they are too clumsy to manage the number of parts and carriers that we have. I showed the sales staff your prototype yesterday at our weekly meeting. They said they'd call you with more ideas. I gave them your email, phone, fax, pager and cellular numbers--I hope you don't mind. Keep up the good work!" "Thanks," Mike said.

The next day Mike got calls from two sales reps, who wanted more changes to the system. For the rest of the week, he got calls every day and the list of changes piled up.

At the 4 week mark of the project, Mike and Sue estimated that they had received 6 months of changes that they were supposed to have done in a couple of weeks. Mike met with Pat again. "I'm disappointed in you," Pat said. "I promised Al and the sales staff that you would make the changes they wanted. You're not giving the prototyping approach a chance. Just wait until it kicks in."

At the 8 week mark, Pat started to complain that Mike and Sue weren't working hard enough. At 10 weeks, Pat dropped by their cubicles twice a day to check on progress. At 12 weeks the agents were complaining and Pat said, "We have to give them something." Mike and Sue commented out the code under development and released a version that consisted mainly of bug fixes and corrections to the annoying user interface for orders, roughly what they had planned to develop and release in the first place, but it took nearly 15 weeks before it was implemented, instead of a few weeks.

a. **Is the prototyping development method appropriate in this case? Describe why or why not in 2-4 sentences or phrases. (5 points)**

b. **If prototyping is not appropriate, what method should be used? Name one alternative method that would be appropriate and briefly justify your choice in 2-4 sentences. If prototyping is appropriate, explain how it should be executed differently to avoid the problems in this case study in 2-4 sentences or phrases. (5 points)**

c. **List at least 4 errors made by this development team in their execution of this project. For each error, describe what should have been done instead, in 1-2 sentences or phrases. (5 points)**

d. **Outline the key steps in the development method that you proposed in step b above. List at least 4 steps; describe each in 1-2 sentences or phrases. (5 points)**

2. **Data model (19 points)**

You are given the following set of business rules for MIT's new subsidiary of the aircraft parts business, the hang glider business: MITGliders, or MITG for short.

a. MITG manufactures products. Each product has a product ID and a sales type (wholesale or retail).
b. Each sales type has a description.
c. Each MITG product has a single sales type. There may be many products of each sales type.
d. Each MITG product is one of two types:
    i. Finished hang glider
    ii. Hang glider assembly, such as a wing, frame or wire control system
e. Each MITG product is either a finished glider or an assembly. A finished glider is a product. An assembly is a product. (Model this as a pair of optional one-to-one relationships.)
f. Each finished glider has a product ID, a glider description and a glider type (high performance, intermediate or beginner craft)
g. Each glider type has a description.
h. Each glider has a unique glider type. There may be many gliders for each glider type.
i. Each assembly has a product ID and a description.
j. MITG buys assemblies from vendors. Each vendor has a vendor ID and a name.
k. Each vendor may make one or many assemblies, and each assembly may be made by one or many vendors.
l. Each assembly is uniquely identified by the combination of MITG assembly product ID and the vendor ID.
m. Each assembly made by a vendor has a vendor assembly ID, vendor assembly price and a vendor assembly description.

You must draw a data model that corresponds to this set of business rules. Follow these steps. You only need to turn in one drawing that includes all the elements listed in steps a-e.

a. **Draw a box for each entity: give each an appropriate name (4 points)**

b. **List the attributes in the box for each entity (5 points)**

c. **Indicate the primary key for each entity either by underlining it or by placing the phrase (PK) next to its name. (2 points)**

d. **Draw all relationships between the entities in the model. Indicate foreign keys by placing the phrase (FK) next to attributes that are foreign keys. (5 points)**

e. **Indicate the cardinality of the relationship: many-many, many-one or one-one. Use crows-foot notation; if you use another notation, define it. (3 points)**

To repeat: You only need to turn in one drawing that includes all the elements listed in steps a-e above.

3. **Database. (21 points)**

Based on the data model in question 2, you construct a database where the tables, attributes and relationships correspond exactly to the data model structure. You are now asked to write the following SQL queries against your database. You may use either 'standard' SQL or MS Access SQL syntax. Indicate which you are using.

Do any three of the following four questions. If you wish, you may do all 4; you will receive credit for the best three answers (and zero points for the fourth one).

a. **List the name and vendor ID of all vendors that supply at least one assembly to MITG. List each vendor only once. (7 points)**

b. **List the product ID and glider description of all high performance hang gliders with a wholesale sales type. Assume the code for high performance is "H" and for wholesale is "W" (7 points)**

c. **List the name and vendor ID of all vendors whose average assembly price is above $50. (7 points)**

d. **Delete all vendors that make assemblies with retail sales type ("R"). Assume that cascade delete is enabled. (7 points)**

To repeat: do only 3 of the 4 questions above.

4. **World Wide Web. (20 points)**

For each of the following questions, give a short answer (2-4 sentences or phrases):

a. Compare and contrast HTML and XML tags. Define each; describe their differences. (4 points)

b. **Who defines HTML tags? How can a new HTML tag be added to the HTML language? (4 points)**

c. **Who defines XML tags? How can a new XML tag be added? (4 points)**

d. Describe the security provided by JavaScript running on a user's browser. You may discuss issues related with any version of JavaScript. (Your text describes early versions of JavaScript, and the same general security issues remain in later versions.)

i. What PC resources can JavaScript access on a user's computer? Can JavaScript access files, directories, monitor, or network? (3 points)

ii. Describe at least two potential security problems that JavaScript's access to the user computer may create. (2 points)

iii. **Contrast the security level of using XML and XSL (and any related elements such as cascading style sheets) with the security level of using JavaScript on the client computer. (3 points)**

5. Telecommunications networks. (20 points)

Seven layer model. Describe the 7 layer ISO model as it is used in the Internet. Use HTTP and TCP/IP as the only examples of the higher layers.

a. Name each of the layers and, in 1 sentence or 1 phrase, define its role. Name and describe the principal (or defining or characteristic) unit of data that is transmitted at that level. You do not need to identify layers that are rarely or never used in the Internet. (5 points)

b. Describe, in 2-4 sentences, how a multi-layered model (like the ISO 7 layer model) allows a variety of network technologies to be integrated to provide apparently seamless communications across the Internet. (5 points)

c. Network technology for local loop access between central office and end user: List the data network technologies or protocols that can be supported over copper wires from a central office to an end user (residence or business). List at least 3 options. (5 points)

d. Local loop, continued: What is the typical bandwidth supported by each of the 3 options? You may provide a general range. Describe briefly how one of the higher bandwidth options you list achieves its better performance. (5 points)