

Homework 2
1.264, Fall 2013
Requirements, software estimation
Due Wednesday, September 18

A. Overview

You will write a text description, with sample Web pages, of a simple supply chain system for an aircraft parts distributor to take and ship orders to its customers. The key aspects of the system are:

1. The aircraft parts distributor has a single warehouse in which all the parts in the catalog are stocked. It has a warehouse management system that stores data on all the parts that are in the warehouse. The system provides the quantity on hand and the price of each part. There are about 5,000 parts handled. Most are jet aircraft parts, but because your CEO is a balloon enthusiast, you also carry a selection of balloon parts.
2. There is a set of freight carriers that the distributor uses to ship the parts to the airlines. There are about 22,000 carriers, though you generally use a much smaller number.
3. There is a set of customers that buy the parts; these are airlines or individuals. We provide a small amount of test data only. Airlines buy jet aircraft replacement parts; individuals buy balloon replacement parts.
4. You will need to create a mechanism to take orders, which can consist of multiple parts. The airlines will pay for the orders via credit card or purchase order. Individuals will pay by credit card.
5. You will need to track the remaining inventory in the warehouse. You may not ship a part that you do not have in stock. You must decide how to handle backorders.

In this homework you will:

1. Write the requirements narrative (10 pages or so) for the system. (You will make the requirements more precise in homework sets 3 and 4 using UML diagrams and data models.)
2. Estimate the size of the system (lines of code), the person months and schedule months required to complete it. These must be consistent with the time you and your partner have available for this course.

B. Requirements narrative

Your ten page document will be a description of the Web-based system the aircraft parts distributor will use to interact with its customers.

Your Web system must contain pages to implement the following processes and information display. We indicate some requirements that your system must meet; you are to define others that you feel are necessary to operate the distribution business.

1. Describe the distributor: general description of products and services, and a description of the company. These can be described very briefly in 1 or 2 pages, with some sample Web pages. Decide on whether jet and balloon parts will be handled together or separately.

2. Create new customer. Decide on the process for this: self-service, or set up by manufacturer, or... A customer registers with the distributor initially. A customer that has had no transactions for a year is removed and must re-register. A customer must inform you of changes in address, phone, etc.
3. Customer login to Web site
4. Customer update of its address, contact or other information
5. Allow customers to browse aircraft parts available and freight carriers available. You must decide if the customers must be logged in to see this information or not.
6. Allow customers to place an order:
 - a. The customer selects a set of parts, and specifies the quantities.
 - b. The customer or the manufacturer can specify the mode and carrier; decide how you wish to do this; you do not have to compute the freight charges.
 - c. The system must compute the total cost of the order, including 5% sales tax. It does not have to compute freight charges.
 - d. The system must accept payment information, either by credit card or purchase order. (You will not actually implement a credit card interface.)
 - e. Your system will assign a unique order number.
7. Display and confirmation of past orders. You do not need to indicate order or shipping status.
8. You should discuss the following awkward issues:
 - a. What to do with the order if items are out of stock, or if the full quantity ordered cannot be shipped
 - b. Must an order be sent in a single shipment, or can it be split among multiple shipments?
 - c. Must a single carrier be used for each order, or can more than one carrier be used? How do you select the carrier(s)?
 - d. Must a shipment go to a single address?
 - e. What error handling will you implement? (Hint: minimal, but describe it)

There are several processes you do not need to consider:

- You do not have to support the processes of updating aircraft parts inventory when new shipments are received at your warehouse, or adding/deleting/changing aircraft parts when the items change.
- You do not have to support adding, deleting or changing freight carriers
- You do not need to consider price changes
- You do not need to consider order status.

Explain your decisions briefly so that implementers understand the design principles. Your system just implements one link of the supply chain: distributor to customer.

C. Data available

The data that is available as your build the system includes:

1. Aircraft parts inventory file. (This is part of the actual Federal Aviation Administration replacement parts approval database, simplified and structured for this homework.) This is also your product catalog.
 - a. Part number. This is the **replacement** part number; it is unique to the replacement part manufacturer (the PMA holder) below.
 - b. Part name. Descriptive name.
 - c. Replacement for. This is the **original** manufacturer part number.
 - d. Approval means. Process or Federal regulation used, identifying number, and date of approval. This must be tracked, as required by regulation.
 - e. Manufacturer. Original part manufacturer. You carry parts only for McDonnell-Douglas aircraft, and also for balloons. Any non-McDonnell-Douglas manufacturer is a balloon manufacturer.
 - f. Entry date. Date that the approval was entered by the US Federal Aviation Administration (FAA)
 - g. Model1 through Model5. A list of the aircraft models for which the replacement part can be used. Examples are DC-8, DC-9, MD-80. In this homework, we have a maximum of 5 models for each part.
 - h. PMA Holder. Manufacturer of the replacement part, referred to as 'Parts Manufacturer Approval (PMA) holder' by this industry.
 - i. PMA Holder Address. Street, city, state, zip code.
 - j. MIDO. Manufacturer Inspection District Office, the FAA office that tests and inspects the replacement part. This information must be tracked, as required by regulation.
 - k. MIDO Address. Street, city, state, zip, phone, fax.
 - l. Price. This is the selling price, in US dollars, for the replacement part.
 - m. Quantity in stock. This is the number of units of this part in the warehouse. Your Web application must check and update this as part of taking an order.
 - n. You don't have data on this, but you have been promised it will be available in the future, so you should design for it: Whether the part can be carried by a given mode (air, highway, rail or water). Some replacement parts are too large to ship by air, and a few are too large to ship by highway (some structural members). Consider this in your requirements; we've placed it here as an example of a 'design-ahead' issue.
2. Freight carriers. This file contains freight carriers that are certified to carry hazardous materials. (This is the actual USDOT approved carriers file.) Buyers of aircraft parts often prefer to use these carriers because their safety and handling standards are high. The file contains:
 - a. Certificate number. The USDOT carrier certificate number for the freight company, used as a unique identifier.

- b. Company name, address. The name and address of the freight carrier. Many of the 'carriers' are brokers or forwarders. These fields include street, city, state, zip code, country, contact name and phone number.
 - c. Mode. This is a 4 digit field (an awkward format) indicating whether the carrier offers
 - i. Highway transportation (1 in column 1)
 - ii. Rail transportation (1 in column 2)
 - iii. Water transportation (1 in column 3)
 - iv. Air transportation (1 in column 4)
3. Customer (airline) file. You will create this. This contains:
- a. Airline or balloon customer name. For example, United, American, Delta.
 - b. Airline or balloon customer address. Street, city, state, zip code, country.
4. You will create your own order and order detail data. The order will contain the 'obvious' data:
- a. Customer.
 - b. Aircraft parts and quantities ordered. Subtotal (price)
 - c. Taxes
 - d. Total order (subtotal plus taxes)
 - e. Freight carrier used to ship the order. You will not include freight charges, a simplification from real life.
 - f. Means of payment: a purchase order or credit card number and expiration date.

D. Assignment

1. You are to write the narrative requirements for the system to support the manufacturer, as described in section B. Use MS Word for the narrative; you may use Visual Web Developer to create sample Web pages if you wish, or you can mock them up in MS Word, Powerpoint or other tool you may know. Include the screen shots in the MS Word document; ask the TAs for help if needed.
2. Estimate the size of the effort. Do this as covered in class. The key steps are:
 - a. Count the function points for each of the systems functions that you will implement. (McConnell, pp 174-177). You will need to estimate the number of database tables, even though you have not designed it yet. While this seems and is unfair, it is also typical in real projects. 20 is a good guess for this project.
 - b. Estimate the lines of code for your system, using McConnell, page 519.
 - i. While you would normally use the Oracle numbers for the database function points, use 10 lines of code per function point instead. You will only do straightforward queries when you implement your system, and you will omit most of the more complex queries, to keep the homework manageable.
 - ii. While you would normally use the perl numbers for the Web application, again you should use 10 lines of code per function point. Perl is the closest match to html and ASP.NET, which you will use to implement the Web

- app. In your homework, you will be given code examples to follow, so that the amount of code you write will be minimal.
- c. Once you have the lines of code, estimate the person months and schedule months. Extrapolate from tables 8-8 to 8-10 to make the estimate. Your project is smaller than 10,000 lines, and the relationships are nonlinear. A very approximate estimate is sufficient; don't spend time fitting curves, etc. Drawing a curve through the points on the graph to extrapolate is perhaps the easiest thing to do. Justify your choice of table (8-8, 8-9 or 8-10) and type of software.
 - d. Compute the team size as person-months divided by schedule months.
 - e. Assign a confidence range to your estimates, based on figure 8-2 (page 168). Never use a point estimate without a range!
 - f. Briefly comment on any other factors that affect the estimates or ranges that you have prepared.

E. Hand in

Hand in an MS Word document on the course Web site.

F. Data example

The aircraft part data is based on the actual FAA replacement parts database. It has been simplified substantially and some data has been invented. An example row is:

Part data:

Part number: KSF127

Part name: Bearing

Replacement for: KSR127104B1

Approval means: Identity per 14 CFR Sec 21.3

Manufacturer: McDonnell Douglas

Entry date: 6/15/99

Model1: DC-10

Model2:

Model3:

Model4:

Model5:

PMA holder: Kamatics Corp

PMA street: 1330 Blue Hills Ave

PMA city: Bloomfield

PMA state: CT

PMA zip: 06002

MIDO: WIN

MIDO street: Bradley International

MIDO city: Windsor Locks

MIDO state: CT

MIDO zip: 06096

MIDO phone: 203.654.1091

MIDO fax: 203.654.1089

Price: \$7.00

Quantity in stock: 2

An example of the carrier data in the dataset is given below; the address and group E are omitted to save space. The carrier data is from a US Department of Transportation database and is given to you 'as is'.

CERT_NO	COMPANY	MODE	GRP_A	GRP_B	GRP_C	GRP_D
0621998510	(GESEACO)	0010	N	Y	N	N
0514990080	O J & R	1000	N	Y	N	N
0602990050	OEIS MARKETS	1000	N	Y	N	N
0716990030	10-4	1000	N	Y	N	N
0608990030	1001 S	1000	N	N	Y	N
0701999990	1049585	1000	N	N	Y	Y
0708999990	1050758	1000	N	N	Y	Y
0603990070	1226934	1000	Y	N	N	N
0607990190	123 INC	1000	Y	Y	Y	Y
0628990010	1243465	1000	N	N	N	Y
0623990040	1243480	1000	N	Y	N	N

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