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Web-based student assessment internet software for university courses

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WEB-BASED STUDENT ASSESSMENT
INTERNET SOFTWARE FOR UNIVERSITY
COURSES

A Thesis

Presented to

The Faculty of the Department of
Computer, Information, and Systems Engineering
San Jose State University

In Partial Fulfillment

of The Requirements for the Degree
Masters of Science in Engineering

by

Kofi Weusi-Puryear

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ABSTRACT

WEB-BASED STUDENT ASSESSMENT INTERNET SOFTWARE FOR UNIVERSITY COURSES.

By Kofi Weusi-Puryear

This thesis explores applying some of the new technology options to Web-based examination systems.

Procedure

First, this study provides a survey of Web-based online testing solutions to evaluate student learning. Then a basic Java/CORBA software solution, called “Evaluator” is implemented and used by university students. Then the opinions of the Evaluator students are compared to those students who were tested using an existing popular solution, WebCT, implemented with Perl/CGI.

Major Result

Students generally agreed that both paper-based and Web-based testing are effective techniques for measuring their comprehension. The functionality of the Evaluator system was also similar to WebCT’s testing module.

Conclusions

Java and CORBA client/server technology can be used to build sound and scalable Web-based student evaluation software. In particular, upcoming framework innovations in the Java language should improve the performance capabilities of such a system.

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I would also like to thank Dr. Glenn Shephard of the College of Business for using my Evaluator program to administer a midterm exam for his class. Thanks are also due to Dr. Steve Zlotolow, Director of Distance Education, for his advice and encouragement.

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1. Chapter 1

1.1. Introduction

In this emerging information age, opportunities for using technology to facilitate education are expanding. Today many college courses are being offered, at least partially, over the Internet (Collis, 1996; Looms, July, 1998). This allows students with busy or unusual schedules to take a few courses or pursue an entire degree. Online courses also allow students to take classes from their university of choice, even if they live long distances away or are confined to their home. Often students in online courses are allowed to work at their own pace. Many types of software tools are used in such courses. One important category of software tools is World Wide Web-based student assessment software. Quizzes, practice tests, and formal exams can now be administered in a computer laboratory or as part of a distance learning course taught over the World Wide Web (A.K.A. the “Web”). There are many such tools available, but they have some technical, economical and pedagogical problems. This research explores some of the problems, and develops and tests a software solution to them.

1.1.1. Description of the Study's Research Questions

This study considers the following questions:

- “What is the general state of Web-based online testing solutions for universities and colleges to evaluate student learning?”
- “Can a Web based student assessment system be implemented using Java and CORBA?”

- “Can such a system provide similar performance and functionality as other systems while offering extra benefits to educational technologists and software designers?”

The author’s hypothesis is that both of the latter two questions can be answered in the affirmative.

1.1.1.1. Importance and Benefits of the Study

Java and CORBA technologies offer new reusable and platform independent options not otherwise available. Using a Java/CORBA solution increases the number of platforms one can run the system’s servers on. This increases the chances of the solution being used by universities and corporations because specialized equipment expenditures may not be required. A Java/CORBA solution also offers more scalability options by using a distributed architecture that allows different modules of a system to be placed on different machines. This makes such a system well suited for the demands of large classes and large numbers of classes. Java also has certain qualities that assist in a Java solution’s components being reused for other purposes or the whole system being integrated into one that offers even more services.

1.1.2. Review of Related Literature

Because the pace of software technology change is so quick (the industry attempts to transform itself every financial quarter) and serious research into Web-based courses is a recent phenomenon, related literature is somewhat limited, particularly in standard journals. A few useful and current print sources however are available.

All materials referenced in this thesis (including books, Web sites, and periodical articles), as well as a few notable additions, are included in the annotated bibliography. The annotated bibliography is organized alphabetically by the

principal author's family name or organizational name. The following table's purpose is to assist the reader in examining the bibliography in a more logical manner.

Table 1

Annotated Bibliography References by Category

Category	Annotated Bibliography Reference
Technology guides	Collis, 1996 Dunigan & Thompson, 1998 Hall, 1997 Orfali, 1998 Looms, Nov. 21, 1998 Shafer, 1998 T.H.E. Journal, 1998 Willis, 1998 Wong, 1999
Surveys and comparisons of existing Web-Based education and training software packages with assessment modules	Hall, 1997 Kristapiazzi, 1998 Landon, 1998 Looms, Nov. 19, 1998 Looms, Jul. 13, 1998 McCormack & Jones, 1998 Schmidt, 1998 Simbandumwe & Tittenberger, 1998 Wichita State University, 1999
Pedagogical Issues	Driscoll, 1998 Looms, 1998 Newby et al., 1996
Assessment content design guides	Newby et al., 1996

1.1.3. Overview of Student Assessment via Web Based Instruction/ Training

There are over one hundred distance learning and training software packages, many of those include a student testing or surveying module (Looms, Nov.,1998). Most popular packages are Web-based because of the high use of the Web by both students and educators (Collis, 1996). Some of the popular packages are WBT System's Top Class, University of British Columbia's Web Course Tools (WebCT), Asymetrix's Toolbook II, Thing Technologies EASeval, Question Mark Computing's Question Mark Software, etc.

Usually the exam is constructed by an instructor, or from a collection of questions provided by the instructor. The exam presented to students is usually in multiple choice or true-false format, but some packages offer other testing methods. After an exam, the student can usually get a report on her or his performance. This report often includes a letter grade, what the student's answers were, and what the correct answers were. Some packages offer more detailed information such as class averages or advice on how to improve performance in the future. Such reports are available to instructors, often along with special information comparing individual students to the rest of the class and information on how the students tended to answer each question.

1.1.4. Reviews of Student Assessment Modules of some Web Based Training (WBT) Applications

Each WBT package tends to be quite different from another. There is a great variation of both services and quality among the vast choices available today. One WBT system may be good for certain course and be completely unsuitable for others. Some software systems can only be hosted on certain hardware platforms and operating systems. Prices also vary greatly from free to hundreds of thousands of dollars (Looms, July, 1998). The author has picked a few of the

popular packages to examine closely in this thesis. See Table 2 for a feature comparison of their student learning evaluation modules.

WebCT, University of British Columbia/Universal Learning Technology (ULT)
WebCT is a Web-based online course authoring and presentation system. A Web browser can be used to both create and take courses with WebCT. It's intended to be used by non-technical people, and includes both timed online testing and student self-testing. WebCT's web site is located at <http://www.webct.com>.

Top Class, WBT Systems
TopClass is a Web-based online training solution. With it, an authorized instructor can develop courses and tests with a Web-based tool. TopClass also has converters and assistants to translate Microsoft Office or rich text format documents to TopClass online materials. WBT Systems' web site is located at <http://www.wbtsystems.com>.

Toolbook II, Asymetrix
The Toolbook II software suite has two main components, the Toolbook II Assistant, and the Librarian. The Assistant is for organizing, creating, and deploying a course. The Librarian is for managing the course, tracking students, and enabling online collaboration. It is easy to use and will appeal to any organization that needs to create and deploy training to employees without having to rely on the skills of an instructional designer. Content can be distributed via the Internet, an intranet, a local area network, or CD-ROMs. Toolbook II can be found on Asymetrix's product web site at <http://www.asymetrix.com/products>.

The following table compares the features of the three above-mentioned systems.

Table 2

Feature comparison of the student learning evaluation modules of three popular WBT packages

Features	WBT Systems TopClass	Univ. / Brit.Col. WebCT	Asymetrix Toolbook II
No HTML knowledge required to develop quiz material	YES [†]	YES [†] , but can use HTML for more flexibility	YES [†]
Password and username security	YES [†]	YES [†]	YES [†]
Multiple choice self test tutorial questions - (automatic marking)	YES [†]	YES [†]	YES [†]
Question file upload capability.	YES [§]	YES [§]	NO, unless part of document being converted
Imagemap questions (click on the correct part of the image).	YES [§]	NO [§]	NO
"Fill in the blank" self test tutorial questions - (automatic marking)	YES [†]	YES [†]	YES [†]
Timed quizzes (graded with permanent mark retention)	YES [†]	YES [†]	YES [†] , but only when using Java Applets

[†] (Simbandumwe & Tittenberger, 1998)

[§] (Wichita State University, 1999)

Table 2 Continued

Feature comparison of the student learning evaluation modules of three popular WBT packages

Features	WBT Systems TopClass	Univ. / Brit.Col. WebCT	Asymetrix Toolbook II
On line marking and grades management of timed quizzes	YES [†]	YES [†]	NO [†]
Generate random set of questions from a pool	YES [†]	YES [†]	YES [†]
Student can view own grades and compare to class summary data	NO [†]	YES [†]	NO [†] (own grades only)
Generate random questions	YES [†]	YES [†]	YES [†]
Uses Java in authoring of tests	NO	NO	YES [*]
Doesn't require knowledge of Java in authoring of tests	YES [*]	YES [*]	YES [*]
Supports graphics files adjacent to quiz questions.	YES [§]	YES [§]	YES
Windows NT 4.0 Server	YES [‡]	YES [‡] , but with some technical problems	YES [‡]
Unix Server	YES [‡]	YES [‡]	YES [‡]

^{*} (Kristapiazzi, 1998)

[§] (Wichita State University, 1999)

[‡] (Landon, 1998)

Table 2 Continued

Feature comparison of the student learning evaluation modules of three popular WBT packages.

Features	WBT Systems TopClass	Univ. / Brit.Col. WebCT	Asymetrix Toolbook II
Apple Macintosh Server	YES [‡]	NO [‡]	NO [‡]
Requires Java/JavaScript on Web Client	Unknown	YES (JavaScript for timed tests)	YES

2. Chapter 2

2.1. Description of “Evaluator”, the Study’s Student Assessment System

2.1.1. Introduction

The author has attempted to create a basic but useful Web-based student assessment system called “Evaluator” using Java and CORBA technologies. The Evaluator System’s purpose is to administer exams and quizzes to students via a World Wide Web browser. After an exam is given, the student or the course’s instructor can retrieve the student’s answers and grades. Instructors also create the exams and quizzes via a Web browser and a text editor. Evaluator uses Java Servlets and applications to create a system for making and using Web-based student assessment tools. Evaluator consists of many tiers of networked software, each communicating with one or two other tiers. CORBA technology is used to allow the Evaluator system to be distributed across more than one machine. An ODBC compliant relational database is used for persistent data storage.

2.1.2. Choice of Java Servlets over Applets

All student and teacher interaction with the Evaluator system will be from a Web browser using only html forms. This ensures the user interface will not be complicated to use and is available on all platforms and popular browsers. The user interfaces for administrators include some Java Applets since it is assumed that server administrators will be technically proficient people who can cope with any Java Applet technical issues. Much more functionality and fancier instructor and student client interfaces could have been offered using Java Applets. However, there are two problems with using Java Applet clients.

1) Applet Security Limitations:

Java applets can be embedded in a Web page and offer the sort of programmable functionality most people expect from native applications. However, such powerful technology could easily be abused to transmit harmful programs that could spy on or wreck an unsuspecting client's computer. Thus, JavaSoft gave all Java applets certain restrictions so that an untrusted applet could be run over a network without the client worrying that they could do harm. Applets loaded over the Internet or LAN are prevented from reading and writing files on the client's file system, and from making network connections except to the originating host (the computer the applet was retrieved from). Java Applets loaded over a network are also prevented from starting other programs on the client's computer. Applets loaded over a network are also not allowed to load libraries, or to define native method calls (if an applet could define native method calls, that would give the applet direct access to the underlying computer). Applets can be electronically signed, but the security restrictions still apply if the client user for some reason decides to not trust the signature (JavaSoft, 1998). Such restrictions are necessary, but can limit what Java programmers can offer.

2) Web Browser Support of Java is not Consistent:

Different Web browsers support Java Applets in different and sometimes erroneous ways. Of course different versions of the same Web browser product support Java differently (the older versions not supporting Java at all). Even the same version of a Java-enabled Web browser on different machine platforms can have vast differences in how it supports Java Applets. The author was faced with these issues personally while performing duties as a graduate assistant for a human computer interaction (HCI) class. The class was offered over the Internet and teleconferencing lines (The online description of the HCI course can be found at <<http://www.engr.sjsu.edu/~knapp/hci.html>>). An exam was given in both email and Java Applet formats. None of the students used the Java Applet method. Some students had trouble downloading the right class files. Others had browsers that did not support Java 1.1 Applets. Others simply preferred to use the more the familiar interface of their email program, perhaps even printing out the exam and submitting a hard copy. Inconsistent support in browsers should become less of a problem in the future, since JavaSoft is stabilizing the Java platform. In addition, more browsers are supporting Java by using the implementation that is supplied along with the operating system, as opposed to engineering their own Java Virtual Machine (VM).

Companies like Zero G Software are making Java installation products for installing Java applications on any platform easy. However the author used Zero G's "Install Anywhere" program in the HCI class and students still had installation problems. In any case, it is easier for students to view simple HTML pages in their familiar and ubiquitous Web browser.

2.1.2.1. Advantages of Java Servlets

Using Java Servlets on the server-side solves most of the browser incompatibility issues as well as many others problems (Shafer, 1998). Java Servlets are Java

programs that are specially designed to respond to HTTP requests and return data via HTTP. Thus, a programmer can shift the complexity and risk from the client to the server by using Java Servlets on the server and feeding clients HTML pages. Servlets and other HTTP/CGI based solutions are slower than Java Applications and Java Applets when it comes to ping rates, but they are over 14 times faster than all the other CGI solutions (Orfali & Harkey, 1998, p. 278-280, 252-253).

2.1.3. Evaluator's advantages over non-Web based systems

Evaluator was designed to have the following in common with other Web-based systems such as WebCT:

- 1) Can be used for both off-site practice quizzes and in laboratory exams.
- 2) Amount of practice and learning curve can be qualitatively measured.
Collected data can be used to improve and predict outcomes of future classes.
- 3) Easy test administration in a lab setting.
- 4) Easy test administration for large classes.
- 5) Easy to update tests for new course content or just to prevent cheating.
- 6) Easy insertion of exam results into a database for analysis and data mining, thus leading to better future courses.

2.1.4. Evaluator's advantages over WebCT

Evaluator was designed to have the following advantages over WebCT and other Web-based systems.

Web-based student clients present only HTML 2.x compliant code, so it is available to a very wide audience.

Have all the cross-platform, deployment, and scalability advantages of Java, CORBA, and HTML. Teachers can design tests on almost any computer they want. The system can run on any machine with a Java 1.1 compliant Virtual Machine using an SQL database with a JDBC driver. Parts of the system can be run on one powerful machine, or distributed across many machines and or CPU for better performance under the pressure of a large number of users.

The following table compares the features of the Evaluator and WebCT software packages.

Table 3

Feature comparison between Evaluator and WebCT

Features	Evaluator	WebCT
No HTML knowledge required to develop quiz material	YES	YES [†] but can use HTML for more flexibility
Password and username security	YES (username must be a personal ID number)	YES [†]

Table 3 Continued

Feature comparison between Evaluator and WebCT

Features	Evaluator	WebCT
----------	-----------	-------

[†] (Simbandumwe & Tittenberger, 1998)

Multiple choice self test tutorial questions - (automatic marking)	NO	YES [‡]
Question file upload capability.	YES	YES [‡]
Imagemap questions (click on the correct part of the image).	NO	NO [‡]
One question at-a-time testing capability.	YES (required)	NO
"Fill in the blank" self test tutorial questions - (automatic marking)	NO	YES [‡]
Timed quizzes (graded with permanent mark retention)	YES	YES [‡]
Generate random set of questions from a pool	NO	YES [‡]
Student can view own grades and compare to class summary data	NO	YES [‡]
Generate random questions	NO	YES [‡]
Uses Java in authoring of tests	YES	NO

Table 3 Continued

Feature comparison between Evaluator and WebCT

Features	Evaluator	WebCT
----------	-----------	-------

[‡] (Wichita State University, 1999)

Doesn't require knowledge of Java in authoring of tests	YES	YES*
Supports graphics files adjacent to quiz questions.	YES** (using html tags only)	YES [§]
Windows NT 4.0 Server	YES	YES [‡] , but with some technical problems
Unix Server	YES**	YES [‡]
Apple Macintosh Server	YES**	NO [‡]
Requires Java/JavaScript on Web Client	NO	YES (JavaScript for timed tests)

2.1.5. Detailed Description of Evaluator System

The Evaluator system was built with the Three-Tier Client/Server Model in mind. The model includes the following three layers:

1. A client tier for objects that provide an interface to end-users.
2. A middle tier for objects that actually perform the work of the program (also known as the objects with the Business Logic).
3. A data tier of objects that save and/or retrieve data from data storage systems.

Evaluator's client tier consists of HTML pages, most of which have form tags embedded in them. When a user finishes a form, a processed message is sent to one of the Java Servlets in the middle tier. The Servlets were all running inside of

** Not tested

[§] (Wichita State University, 1999)

Java Web Server (JWS), trial version 1.1.3 (available from <http://www.sun.com/software/jwebserver/>). JWS also served all static Evaluator Web pages. Java Web Server was used because Servlet configuration relatively simple, most Servlets are automatically reloaded after they have been recompiled, and output from each Servlet can be easily viewed when running JWS from Windows NT's command line. The Evaluator Servlets usually communicate with Evaluator's CORBA ORB via IIOP. The ORB is Inprise's VisiBroker version 3.2 (available from <http://www.inprise.com/visibroker>) and communicates with several stand-alone Java Programs. Often the Java Program performs some more processing after receiving a message from the ORB. It then communicates with the data tier via a database object, retrieving or saving information in an ODBC compliant Sybase SQLAnywhere 5.0 database (upgraded versions are available from <http://www.sybase.com/products/anywhere>). Symantec's dbANYWHERE database connectivity software (available at <http://www.symantec.com/dba>) facilitates efficient and reliable communication between the Java database object and the Sybase database. All Java VMs used were from JavaSoft's Java Development Kit (JDK) 1.1.6 with the exception of the JWS Web server that was run in JDK 1.2. All JDK's can be found on JavaSoft's web site at <http://www.javasoft.com/products/jdk>.

Figure 1 is a diagram of some of the pieces of the Evaluator system that facilitate the saving of a student's response to an exam question. It is a good example of a pattern repeated throughout the Evaluator system.

The Evaluator system's Java and HTML source codes, Rational Rose 98 (available from <http://www.rational.com>) logical view diagrams, and screen shots are enclosed with this thesis on diskettes. Also, the screen shots and logical view diagrams are in the appendix.

Figure 1: Diagram of SaveAnswers subsystem of Evaluator

3. Chapter 3

3.1. Design of the Study

Students in courses offered by the College of Business at San Jose State University took their midterm exams using Web based assessment systems. Two classes had their midterms using the WebCT system.^{*} A third class used the Evaluator system.^{**} Differences between the two exam administrations, besides which system they used, were minimized as much as possible. Surveys were given to all the students to measure the perceived effectiveness of the systems. A comparison of the survey results should answer at least the first question of this study. The questionnaire used in the survey follows in Figure 2. Figure 3 shows the mean agreement scores for each opinion.

^{*} Business 115, Advanced Telecommunications, Sections 1 and 2, both taught by Dr. Glenn Shephard.

^{**} Business 118B, Decision Support and Expert Systems, Section 2, taught by Dr. Glenn Shephard.

STUDENT OPINION OF PAPER AND WEB-BASED ASSESSMENT

Course _____

You are being asked to provide your opinion regarding class examinations given on paper and over the World Wide Web (or just the "Web" for short). This survey is contributing to a master thesis. Please do not provide your name as this questionnaire is anonymous. You may also supplement this anonymous questionnaire with a formal signed letter to:

Kofi Weusi-Puryear, c/o CISE Dept., San Jose State University, San Jose CA, 95192

If you choose to write a letter, your identity will remain anonymous and will not be published.

For each item in the "Opinions" column circle in the letter in the "Answers" column that corresponds with the desired opinion in the following agreement/disagreement rating scale.

I completely agree	I agree	I am neutral or I do not know	I disagree	I completely disagree
A	B	C	D	E

	Opinions	Answers
1	Compared to taking a multiple choice/true-false exam on paper, taking an exam via the Web was easier.	A B C D E
2	During my Web-based exam, I often experienced annoying delays between when I gave the Web browser a command and when it actually processed my request.	A B C D E
3	I found the look and feel of the Web-based exam distracting me from the exam's questions and answer choices.	A B C D E
4	It was just as easy to understand what I should do to mark my answer on the Web-based exam as it is on paper-based exams.	A B C D E
5	I felt just as comfortable taking an exam on the Web as I do taking paper exams.	A B C D E
6	Paper-based testing is an effective technique for measuring my comprehension.	A B C D E
7	Web-based testing is an effective technique for measuring my comprehension.	A B C D E
8	No student should be forced to take a paper-based exam.	A B C D E
9	No student should be forced to take a Web-based exam.	A B C D E
10	Paper-based, multiple choice/true-false exams should only be used for quizzes that count less than 5 percent of a student's grade.	A B C D E
11	Web-based, multiple choice/true-false exams should only be used for quizzes that count less than 5 percent of a student's grade.	A B C D E
12	I understood the report of my results from the Web-based exam (Mark C if you never saw the report on the Web, or if you never saw a print out of it).	A B C D E

Please circle your classification:

Freshman Sophomore Junior Senior Graduate Student Other (e.g., Open University, Audit, etc.)

Figure 2: Survey questionnaire given to classes that used WebCT or Evaluator

3.1. Presentation and Analysis of Results

Figure 3: Mean Agreements of Opinions

The opinions are along the X-axis in Figure 3. The Y-axis shows the mean level of agreement for each user group. A score of 1 would denote an average of complete agreement with the opinion, 0.5 for simple agreement, 0 for neutral and unsure opinions, -0.5 for simple disagreement, and -1 for complete disagreement. The “WebCT Users” group (darker bars) consists of 77 students who took a midterm using WebCT. The “Evaluator Users” (lighter bars) consists of 21 students who took a midterm using Evaluator. Regrettably, only 21 Evaluator users could be surveyed, and thus their responses are not significant. Originally, two classes were supposed to use Evaluator and later be surveyed. Unfortunately, Evaluator was not developed in time to be used by more than one class section due to problems with database drivers.

3.2. Summary of Analysis Results

Overall, opinions were not strong since no opinion received a score of $|0.5|$ or more agreement/disagreement by either the Evaluator or WebCT users.

The most pronounced results were for Opinion #4. WebCT users exhibited a mean score of 0.49 (followed by a mean score of 0.19 from Evaluator users), agreeing that:

- It is just as easy to understand how to mark answers in Web-based exams as in paper-based exams.

WebCT user’s scores on Opinions #1, #2, #5; and #12 indicate that most WebCT users agree with the following opinions:

- Compared to taking a multiple choice/true-false exam on paper, taking an exam via the Web was easier.

- During my Web-based exam, I did not often experience annoying delays between when I gave the Web browser a command and when it actually processed my request.
- It was just as easy to understand what I should do to mark my answer on the Web-based exam as it is on paper-based exams.
- I felt just as comfortable taking an exam on the Web as I do taking paper exams.
- I understood the report of my results from the Web-based exam.

Evaluator user's scores on Opinions #3, and #9 indicate that most Evaluator users agree with the following opinions:

- I found the look and feel of the Web-based exam distracting me from the exam's questions and answer choices.
- No student should be forced to take a Web-based exam.

Both Evaluator and WebCT user's scores on Opinions #6, and #7 indicate that most student users agree that:

- Both paper-based and Web-based testing are effective techniques for measuring my comprehension.

4. Chapter 4

4.1. Conclusions

The creation of a working Evaluator system means the answer to "Can a Web based student assessment system be implemented using Java and CORBA?" has

been found to be in the affirmative. The survey results have also shown that such a system can provide similar functionality as other systems. However, there are some look and feel, and to a much lesser extent, performance issues. Focus groups and the consulting of professional educators and Web page designers can help improve the appearance of Evaluator's reports and so that the Web pages do not distract students from the content of the exam's questions and answers.

Although the score was not statistically significant, the author is concerned that an average score of 0.17 indicated that many of the Evaluator users experienced annoying delays. The performance issues are a technical problem that needs to be addressed if a system like Evaluator is to be used for large classes or for a large student population. The author experienced many problems finding a database driver that had acceptable performance and reliability characteristics. After two weeks of testing configurations and drivers, it was found necessary to use Symantec's database middleware and deploy the database on a separate machine from the rest of the server components to get acceptable data retrieval speeds. Running two communicating Java VMs on one machine is actually slower than running them on two machines. A local ping via CORBA was found to be about 3.9 msec as opposed to 3.6 msec remote ping between two computers via CORBA/10 Mbit/sec Ethernet. The Java VM seems to be CPU intensive enough to offset the network overhead (Orfali & Harkey, 1998). Developing a server side infrastructure for efficiently managing server objects would have been prohibitively time consuming. It is also unnecessary, since JavaSoft has already designed such a framework, namely Enterprise Java Beans (EJB). However at development time the author was well aware that no implementation of the EJB framework would suit the needs of the project. The author was also deeply involved and privy to tests of exiting EJB products, most of which were still in Beta or were release candidate 1 versions. Implementation of separate server programs running in there own Java VMs was more feasible in the short term.

However, significant improvements in EJB implementation are expected as early as late summer 1999.

The short answer to the question “What is the general state of Web-based online testing solutions for universities and colleges to evaluate student learning?” is “diverse and blossoming.” Surely, any educator persistent enough to scour the Web can find something for their needs. Looms’ Website entitled “Survey of Course Management and Test Delivery Systems” (June, 1999) is a great starting point. The main issues an instructor will have to face are costs, development time, what level of technical expertise is required (by the instructor, the students, and the server’s administrators), and what client and server platforms are supported. The platform issues are still problematic even for the few systems implemented using Java (for reasons cited above). The author has not found another Web-based assessment solution that also claims to use CORBA to enhance performance, scalability, and communication.

4.2. Suggestions for Future Work

- Provide surveillance with the system. A software-controlled camera could be used so that a course instructor can watch a student while they are taking an exam. Periodic snapshots should be saved in the data store along with the student’s answers to the exam. This gives similar security measures as exams administered in a classroom or lab. Instructors (or sophisticated image analysis programs) can verify that the right person took the correct exam at the proper time by comparing the snapshots to student ID photos. Alternatively, measures that are more expensive could be used, such as retina scanners.
- Allow an instructor to grant a student more time on an exam if he or she feels the exam was interrupted for a legitimate reason, e.g., a family emergency.

- Detect technical problems (e.g., a server crash, serious TCP/IP networking problems) and give students an appropriate amount of extra time to finish their exams.
- Give the option of plugging in an object database instead of just an ODBC compliant one.
- Solicit the expertise of professional educators and Web-page designers to improve the look, feel, and readability, of Evaluator's Web pages.
- Offer ways for the instructor to change the look and feel of the Web pages and well as add custom links, pictures, sounds, and other media.
- Upgrade all Java code to the Java 2 Platform (also known as Java Development Kit 1.2), including the use of new Collection interfaces, high performance algorithms, and the passing of any serializable Java object across a network via CORBA.
- Manage business and data tier objects within an EJB server in order to decrease delays and take full advantage of Java scalability towards supporting more users.

References:

- Collis, B. (1996). Tele-learning in a digital world: the future of distance learning. London: International Thomson Computer Press.
- Driscoll, M. (1998). Web-based training: using technology to design adult learning experiences. San Francisco: Jossey-Bass/Pfeiffer.
- Dunigan, J. L., & Thompson, J. C., Jr. (1998, November). Software Solutions, 26(4). Retrieved from the World Wide Web:
<http://www.thejournal.com/journal/magazine/98/nov/sw.asp#1>
- Hall, B. (1997). Web-based training cookbook. New York: Wiley Computer Pub.
- Harrison, N. (1999). How to design self-directed and distance learning: a guide for creators of web-based training, computer-based training, and self-study materials. New York: McGraw-Hill.
- JavaSoft. (1998, July 23). Frequently Asked Questions - Java Security. Retrieved from the World Wide Web: <http://java.sun.com/sfaq/>
- Kristapiazzi, G. (1998, July 21). Compare Web Tools for Course Authoring. Retrieved from the World Wide Web:
http://www.geocities.com/Eureka/Gold/6012/compare_Web_tools.htm
- Landon, B. (1998, December 16). Comparison of Online Educational Applications. Retrieved from the World Wide Web:
<http://www.ctt.bc.ca/landonline/sbsall.html>

Looms, T. (1998, July 13). Trends in Test Creation, Delivery and Management Systems for Distance Learning. Retrieved from the World Wide Web: <http://tangle.seas.gwu.edu/~tlooms/TRENDS/index.html>

Looms, T. (1999, June 6). Survey of Course Management and Test Delivery Systems. Retrieved from the World Wide Web: <http://tangle.seas.gwu.edu/~tlooms/assess.html>

Looms, T. (1998, November 21). Issues Concerning Web-Based Assessment and Testing. Retrieved from the World Wide Web: <http://tangle.seas.gwu.edu/~tlooms/research.html>

McCormack, C., & Jones, D. (1998). Building a Web-Based Education System. New York: Wiley Computer Pub.

Newby, Timothy J. (Ed.), Donald A. Stepich, James D. Lehman, & James D. Russell. (1996). Instructional technology for teaching and learning: designing instruction, integrating computers, and using media. San Francisco: Merrill/Prentice-Hall.

Orfali, R., & Harkey, D. (1998). Client/Server Programming with Java and CORBA (2nd ed.). New York: John Wiley & Sons.

Schmidt, W. C. (1998). WWW Survey Assistant - Rates & Competition. Retrieved from the World Wide Web: <http://or.psychology.dal.ca/~wcs/hidden/SAdocs/competition.html>

Shafer, D. (1998, september 28). Java servlets could save the day.
Builder.com. Retrieved September 28, 1998 from the World Wide Web:
<http://www.builder.com/Programming/Shaffer/092898/>

Short Takes. (1998, September). Technological Horizons In Education Journal (T.H.E. Journal), 26(2). Retrieved from the World Wide Web: <http://www.thejournal.com/journal/magazine/98/sept/telecom.asp#3>

Simbandumwe, J., & Tittenberger, P. (1998, February 23). Tools for Developing Interactive Academic Web Courses. UMIinfo. Retrieved from the World Wide Web:
<http://www.umanitoba.ca/ip/tools/courseware/evalmain.html>

Wichita State University. (1999, May 14). General Features.
Retrieved from the World Wide Web: <http://www.Webct.com/wichita-state-eval.html>

Wilis, W. (1998, November). Focus On Career and Training Software.
Technological Horizons In Education Journal (T.H.E. Journal), 26(4).
Retrieved from the World Wide Web:
<http://www.thejournal.com/journal/magazine/98/nov/sw.asp#2>

Glossary

CORBA

Common Object Request Broker Architecture. It is a product of the Object Management Group (OMG), a consortium of over 800 computer industry companies. CORBA is a specification for how to implement a cross platform ORB. OMG maintains an informative web site at <http://www.omg.org>.

Java

A Sun Microsystems object oriented programming language and platform for developing software. Java programs can run under any operating system that has a Java Virtual Machine program written for them.

ORB

Object Request Broker. An ORB is an object bus. It lets objects transparently make requests to, and receive responses from, other objects located remotely or locally. The objects can be written in almost any language.

Web Browser

Tools primarily for retrieving and viewing HTML documents via the World Wide Web service of the Internet

Annotated Bibliography

- Collis, Betty. Tele-learning in a digital world: the future of distance learning. London: International Thomson Computer Press, 1996
Chapter 10.2 The WWW as the “Killer App” for Tele-Learning is a good discussion how the Web is effecting the future of distance learning.
- Driscoll, Margaret. Web-Based Training: Using technology to design adult learning experiences. San Francisco: Jossey-Bass/Pfeiffer, 1998
Chapter 7 covers online student assessment and Chapter 9 has is comparison of Web classroom builders.
- Dunigan, Janet L., and Jay C. Thompson, Jr. “Software Solutions” Technological Horizons In Education Journal (T.H.E. Journal). (Nov. 1998): Online. Internet. Nov. 1998. Available World Wide Web: <http://www.thejournal.com/journal/magazine/98/nov/sw.asp#1>
This article mentions Ball State University’s inQsit software, an Internet-based testing/quizzing/surveying package that allows for randomized test questions, color graphics, sound and movie clips, and password protection for both students and a local test proctor.
- Hall, Brandon. Web-based training cookbook. New York: Wiley, 1997.
A well known book (with CD-ROM) written by Web-Based Training guru Dr. Brandon Hall is still very useful even though it was published in 1997. It covers everything from planning, to team building, to implementation of a Web-based corporate training site. Up-to-date information can always be acquired from Dr. Hall’s Website at <http://www.brandon-hall.com>. Although the book is very much geared towards industry training, Chapter 9 on Online Testing is very relevant to this thesis.
- Harrison, Nigel. How to Design Self-Directed and Distance Learning Programs. New York: McGraw-Hill, 1999
Section 2.5 covers test question design.
- Kristapiazzi, Geri. Compare Web Tools for Course Authoring. Online. Internet. July 21, 1998 1998 Available World Wide Web: http://www.geocities.com/Eureka/Gold/6012/compare_Web_tools.htm
An evaluation of CMI (Computer Managed Instruction), CBT (Computer Based Training), and WBT (Web Based Training) Authoring software. Created to determine the best use of such systems to facilitate

the creation and administration of a Web-based educational environment for Daytona Beach Community College (DBCC).

- Landon, Bruce. Comparison of Online Educational Applications. Centre for Curriculum, Transfer & Technology, British Columbia, 1998. Online. Internet. Dec. 16, 1998 Available World Wide Web: <http://www.ctt.bc.ca/landonline/sbsall.html>
Compares the availability of software features for many different online educational applications.
- Looms, Thelma. Trends in Test Creation, Delivery and Management Systems for Distance Learning. Thomson Labs, Jul. 13, 1998. Online. Internet Jul. 13, 1998 Available World Wide Web: <http://tangle.seas.gwu.edu/~tlooms/TRENDS/index.html>
- Looms, Thelma. Survey of Course Management and Test Delivery Systems. Thomson Labs, Nov. 19, 1998. Online. Internet. Nov. 19, 1998 Available World Wide Web: <http://tangle.seas.gwu.edu/~tlooms/assess.html>
Extensive and constantly updated coverage of Course/Test Management and Delivery and Test Creation/Delivery Tools and Systems.
- Looms, Thelma. Issues Concerning Web-Based Assessment and Testing. George Washington University, 1998. Online. Internet. Nov. 21, 1998 Available World Wide Web: <http://tangle.seas.gwu.edu/~tlooms/research.html>
Includes coverage of security and pedagogy issues.
- McCormack, Colin, and David Jones. Building a Web-Based Education System. New York: Wiley, 1998
Chapter 7 on online student assessment, and a comparison of web classroom builders in Chapter 9 were relevant to this thesis.
- Newby, Timothy J., Donald A. Stepich, James D. Lehman, and James D. Russell. Instructional technology for teaching and learning: designing instruction, integrating computers, and using media. San Francisco: Merrill/Prentice-Hall, 1996
An invaluable book for anyone designing online education systems. Includes advice on how to write pedagogically sound questions for online testing.
- Orfali, Robert, and Dan Harkey. Client/server programming with Java and CORBA. Second Ed. New York: Wiley, 1998.

Orfali and Harkey provide a very comprehensive guide to using Java with CORBA in building client/server applications, as well as many other competing technologies (such as CGI, DCOM, etc.).

Schmidt, William C. WWW Survey Assistant - Rates & Competition. Dalhousie University Department of Psychology, 1998. Online. Internet. 1998. Available World Wide Web:
<http://or.psychology.dal.ca/~wcs/hidden/SAdocs/competition.html>
Information on Schmidt's S-Ware Web-Based Survey Software. Contains an informative comparison chart to its competition (including ComputerPREP's Web@ssessor).

Shafer, Dan. "Java servlets could save the day" Builder.Com-Voices. (Sept. 1998): Online. Internet. Sept. 28 1998. Available World Wide Web:
<http://www.builder.com/Programming/Shافر/092898/>
This article discusses how Java Servlets could solve browser inconsistency problems.

"Short Takes" Technological Horizons In Education Journal (T.H.E. Journal). (Sept. 1998): Online. Internet. Sept 1998. Available World Wide Web:
<http://www.thejournal.com/journal/magazine/98/sept/telecom.asp#3>
This article lists SCT Education Systems' announcement of a total distance and online learning solution and distance education consulting practice for higher education, as well as ComputerPREP's announcement of version 1.5 of Web-based assessment/survey program Web@ssessor.

Simbandumwe, Jean-Paul, and Peter Tittenberger. UMinfo - Web Tools. University of Manitoba - Winnipeg, MB, Canada, 1998. Online. Internet. Feb. 23, 1998 Available World Wide Web:
<http://www.umanitoba.ca/ip/tools/courseware/evalmain.html>
Comparison of Learning Space, TopClass, WebCT, and Toolbook II Web-based instruction software tools.

Wichita State University. General Features. WebCT Educational Technologies Corporation, 1999. Online. Internet. May 14, 1999. Available World Wide Web: <http://www.Webct.com/wichita-state-eval.html>.
A comparison table of the general features for WebCT, WCB, Blackboard, and TopClass online instruction software tools.

Willis, William. "Focus On Career and Training Software" Technological Horizons In Education Journal (T.H.E. Journal). (Nov. 1998): Online. Internet. Nov. 1998. Available World Wide Web:

<http://www.thejournal.com/journal/magazine/98/nov/sw.asp#2>

This article mentions Invest Destinations 2.0, an online training system that uses Java Applet clients and ODBC compliant management system.

Wong, Wylie. "Firms boost app server features" CNET News.com. (April 23, 1999): Online: Internet. April 23, 1999. Available World Wide Web:

<http://www.news.com/News/Item/0,4,35597,00.html>

Appendix A

This appendix consists of screen shots and UML logical diagrams of the Evaluator system.

Overview of UML components:

Figure A1. Interface, Class, and Implementation Example

Interface Classes with methods: **SaveAnswersIntf** is an interface.

Classes with static members: **SaveAnswersImpl** is a class.

Implementation: Class **SaveAnswersImpl** implements interface **SaveAnswersIntf**. Notice the arrow's line is dashed.

Figure A2. Inheritance Example

Inheritance: Class SaveAnswersImpl is a child of class
_SaveAnswersIntfImplBase. Notice the line of the arrow is solid.

Figure A3. Class showing methods and static members

Figure A4. Containment Example

Containment: Class SaveAnswers contains member object ‘frame’ of class
SaveAnswersFrame.

Figure A5. A note representing a HTML page:

Instructor Administration: Adding

Evaluator Instructor Administration - Netscape

Forward Back Home Search Help

edutek.evaluator.InstrAdminServlet

Instructors Administration

Instructor Name	Personal ID Number
New Instructor	
Dr. Glenn Shephard	123456789

☒ Add the New Instructor
☐ Change/Add Checked Instructor(s)
☐ Remove Checked Instructor(s)

NOTICE: Passwords are initially set to the Personal ID Number

Home Search Help

Document Data Table

Data Services

Instructor Administration: Editing

Navigator | Evaluator Instructor Administration - Netscape | Forward | Home | Search | Help | edutek.evaluator.InstrAdminServlet

Instructors Administration

	Instructor Name	Personal ID Number
☒	Dr. Glenn Shephard	123456789
New Instructor		

☐ Add the New Instructor
☒ Change/Add Checked Instructor(s)
☐ Remove Checked Instructor(s)

Submit Changes

NOTICE: Passwords are initially set to the Personal ID Number

Course Administration: Assigning an Instructor and adding a Course

Navigator Courses Administration - Netscape

Back Forward Home Search Netscape Home

utek.evaluator.CourseAdminServlet

Courses Administration

	Course Name	Instructor, Instructor's PIN
New Course	<input type="text" value="BUS118B-02"/>	<input type="text" value="Dr. Glenn Shephard, 123456789"/>

☒ Add the New Course
☐ Remove Checked Course(s)

Course Administration: Removing, Editing or Viewing a Course

Evaluator Courses Administration - Netscape

Back Forward Home Site Map Help

utek.evaluator.CourseAdminServlet

Courses Administration

	Course Name	Instructor, Instructor's PIN
☒ View/Edit	BUS118B-02	Dr. Glenn Shephard, 123456789
☐ New Course		

☐ Add the New Course
☐ Remove Checked Course(s)

Submit Change(s)

Evaluator Course Viewer - Netscape

tek.evaluator.CourseAdminServlet

Course BUS 118B-02

Instructor: Dr. Glenn Shephard

Use this pull down menu to select another instructor for this course:

Then choose "Submit Change(s)" below.

Enrolled Students:

	Student Name	Personal ID Number
☐	Jane Doe	5555
☐	John Doe	7777
New Student	<input type="text"/>	<input type="text"/>

☐ Add the New Student
☐ Change/Add Checked Student(s)
☐ Drop Checked Student(s)

NOTICE: Student Passwords are initially set to the Personal ID Number

Exams:

	Exam Name
☐	Midterm
New Exam	<input type="text"/>

☐ Add the New Exam
☐ Remove Checked Exam(s)

Submit Change(s)

Data Services

Evaluator Exam Viewer - Netscape

File View Print Home Search Window Help

Back Forward Reload Stop Select Netscape Print Security

Bookmark Location utek.evaluator.CourseViewServlet

BUS 118B-02 Exam: Midterm

Duration:	1 hour(s) and 30 minute(s)
Available at:	00 AM, 3/0/99
Unavailable after:	60 PM, 4/4/99
Number of times exam can be taken:	1

Save Changes

Questions:

Question Type: Multiple Choice

Go to Another Answer
Move the Question Up
Move the Question Down

Title:

Question:

Document Done

Evaluator Exam Viewer - Netscape

Forward Back Home Search

utek.evaluator.CourseViewServlet

Questions:

Question Type: Multiple Choice

ADD ANOTHER ANSWER
GO TO THE QUESTION BANK
VIEW THIS QUESTION DOWN

Title:

Question:

Settings:

Scoring: ☐ Cumulative ☐ All or Nothing

Allow Negative Score: ☐ Yes ☐ No

Answers(Number Indexed):

Answer 1:

Value(%):

Feedback:

Evaluator Exam Viewer - Netscape

Back Forward Home Stop Search Print

http://utek.evaluator.CourseViewServlet

Answers(Number Indexed):

Answer 1:

Value(%):

Feedback:

Answer 2:

Value(%):

Feedback:

Go Another Question

Save changes

Reset All Items in this Form

Document: Done

Exam Administration

User Services

Business Services

Data Services

Question Uploader Page

Evaluator Question Set Upload - Netscape

Back Forward Stop Reload Home

u/evaluator/QuestionsUpload.html

What Course are these questions for?

What Exam are these questions for?

What Evaluator Questions Text File are you sending?

File Upload

☒ Thesis
☒ Unload
☒ MidtermQuestions.txt

TYPE MC
CUMULATIVE_SCORING FALSE
ALLOW_NEGATIVE_SCORE
FALSE
TITLE Multiple Choice Question 45
QUESTION "The water jug problem has the
following rule set that ..."
ANSWER1 0 "X=4, Y=3"
REASON1
ANSWER2 0 "X=1, Y=2"
REASON2
ANSWER3 0 "X=0, Y=7"
REASON3

Question Uploader Page: Response

Questions File Upload Output - Netscape

engr.sjsu.edu/servlet/edutek.evaluator.QuestionsUploadServlet

Response from your input:

ExamName:
Midterm

CourseCode:
test-02

Uploaded file:

Filename: C:\npuryear\MidtermQuestions.txt
Content-Type: text/plain
TYPE:MC
CULM_SCOR:false
NEG_SCOR:false
TITLE:Multiple Choice Question 45
QUESTION:"The water jug problem has the following rule set that describes the permissible operations that are allowed in its problem space:
1. (X,Y|X<4)->(4,Y) Fill the 4-gal jug
2. (X,Y|Y<3)->(X,3) Fill the 3-gal jug

Evaluator Home: Login Page

Evaluator Home - Netscape

Back Forward Reload Stop Search Netscape Print Setup Sign

http://cslab61.engr.sjsu.edu/evaluator/

Welcome to the Evaluator Examination System.

Please enter your personal ID number and password.	
PIN 1442	
Password ****	

Submit

Document Done

Evaluator Login & Redirection

User Services

Business Services

Data Services

Welcome Page: Logged in, Ready to take Exam

Welcome WEUSI-PURYEAR, KOFL - Netscape

Back Forward Reload Stop Netscape

ode=BUS%20118B-02

Welcome to Evaluator

WEUSI-PURYEAR, KOFL.

Exams available for you to take:

Course	Exam Name	Available Until	Duration
BUS 118B-02	Midterm	1999-06-11 14:45:00.0	01:30:00

Exam results available for you to view:

Course: Exam Name: Last Given On:

Student Overview of Exams & Exam Results

User Services

Business Services

Data Services

Evaluator Examiner Page: Starting to take the Exam

Evaluator Examiner - Netscape

File Edit View Go Web Help

http://www.kofi.com/Key=0&examDuration=3420000&studentPIN=1442&studentName=WEUSI-PURYEAR%2C%20KOFI

Back Forward Stop Reload Netscape Print

Question Navigation Bar

Question 1

(10 points)

Question 2

(1 point)

Question 3

(1 point)

Question 4

(1 point)

Question 5

(1 point)

Question 6

(1 point)

Question 7

(1 point)

Hello WEUSI-PURYEAR,
KOFI

Please click on one of the question links. They should be in the frame on the left.

This frame updates about every 30 seconds.
To force an update [click here](#).

Approximate remaining exam time: 1:26:43

User Services

Business Services

Data Services

Question Navigation Frame

Input Page:

Evaluator Examinator
HTML Frameset

Output Page:

HTML Frame:
QuestionNav
Links to Questions

Business Services

QuestionsUploadInit

```

    @RequestMapping(value = "/upload", method = RequestMethod.POST)
    public void uploadQuestions(@RequestParam("questions") List<Question> questions, @RequestParam("courseCode") String courseCode, @RequestParam("examName") String examName) {
        // ...
    }

```

Exam Admin

Exam Admin Init

```

    @RequestMapping(value = "/init", method = RequestMethod.GET)
    public void initExamAdmin() {
        // ...
    }

```

Exam Data

```

    @RequestMapping(value = "/data", method = RequestMethod.GET)
    public void getExamData() {
        // ...
    }

```

```

    @RequestMapping(value = "/question", method = RequestMethod.GET)
    public void getQuestion() {
        // ...
    }

```

```

    @RequestMapping(value = "/question", method = RequestMethod.GET)
    public void getQuestion() {
        // ...
    }

```

```

    @RequestMapping(value = "/question", method = RequestMethod.GET)
    public void getQuestion() {
        // ...
    }

```

Evaluator Examiner Page: Viewing a Question

Evaluator Examiner - Netscape	
<p>Back Forward Home Search Navigation Stop</p>	
<p>Key=0&examDuration=3420000&studentPIN=1442&studentName=WEUSI-PURYEAR%2C%20KOFI</p>	
<p>(1 point)</p> <p><u>Question 21</u> (1 point)</p> <p><u>Question 22</u> (1 point)</p> <p><u>Question 23</u> (1 point)</p> <p><u>Question 24</u> (1 point)</p> <p><u>Question 25</u> (1 point)</p>	<p>Question 0 (1 points)</p> <p>True / False Question 25</p> <p>Agents are used only with hard data.</p> <p> ☐ 0. FALSE ☒ 1. TRUE </p> <p>Save this question</p>
<p>This frame updates about every 30 seconds. To force an update click here.</p> <p>Approximate remaining exam time: 1:21:34</p>	

Save Answers

Question 41
(1 point)

Question 42
(1 point)

Question 43
(1 point)

Question 44
(1 point)

Question 45
(1 point)

Question 46
(1 point)

Question 47
(1 point)

Question 48
(1 point)

Question 49

30 seconds.
To force an update click [here](#).

Approximate
remaining exam
time: 1:24:47

Multiple Choice Question 45

The water jug problem has the following rule set

1. $(X, Y, X < 4) \rightarrow (4, Y)$ Fill the 4-gal jug
2. $(X, Y, Y < 3) \rightarrow (X, 3)$ Fill the 3-gal jug
3. $(X, Y, X > 0) \rightarrow (X - D, Y)$ Pour some water out of the 4-gal jug
4. $(X, Y, Y > 0) \rightarrow (X, Y - D)$ Pour some water out of the 3-gal jug
5. $(X, Y, X > 0) \rightarrow (0, Y)$ Empty 4-gal jug on the ground
6. $(X, Y, Y > 0) \rightarrow (X, 0)$ Empty 3-gal jug on the ground
7. $(X, Y, X + Y > 4 \wedge Y > 0) \rightarrow (X, Y)$ Pour water from 3-gal jug into 4-gal jug
8. $(X, Y, X + Y > 3 \wedge X > 0) \rightarrow (X, Y)$ Pour water from 4-gal jug into 3-gal jug
9. $(X, Y, X + Y < 4 \wedge Y > 0) \rightarrow (X, Y)$ Pour all water from 3-gal jug into 4-gal jug
10. $(X, Y, X + Y < 3 \wedge X > 0) \rightarrow (X, Y)$ Pour all water from 4-gal jug into 3-gal jug

If the start state is $X=0, Y=2$, then what will be the state after 10 steps?

- ☐ 0. none of the above
- ☐ 1. $X=4, Y=3$
- ☐ 2. $X=4, Y=3$
- ☐ 3. $X=4, Y=3$
- ☐ 4. $X=4, Y=3$

[illegible]

Evaluator Examiner Page: End of Exam

Evaluator Examiner - Netscape

Forward Back Home Stop

http://cslab61.engr.sjsu.edu/servlet/edutek.evaluator.ExaminatorServlet?courseCode=BUS%201188-

Multiple Choice Question 49

The macro language use in Excel 97 is called:

- ☐ 0. none of the above
- ☐ 1. visual basic applications
- ☐ 2. java
- ☐ 3. visual basic
- ☐ 4. lotuscript

Question 45
(1 point)

Question 46
(1 point)

Question 47
(1 point)

Question 48
(1 point)

Question 49
(1 point)

Question 50

This frame updates about every 30 seconds.
To force an update [click here](#).

Approximate remaining exam time: 00:00:00
The Exam is Over.

DocumentDone

Evaluator Examiner Page: End of Exam;
trying to get another question to answer

Evaluator Examiner - Netscape

Back Forward Home Search Netscape Print Security Stop

http://cs1ab61.engr.sjsu.edu/servlet/servlet/evaluator.ExaminatorServlet?courseCode=BUS201188-7

Question Navigation

Bar

Question 1
(10 points)

Question 2
(1 point)

Question 3
(1 point)

Question 4
(1 point)

Sorry, the exam is over.

This frame updates about every 30 seconds.
To force an update [click here](#).

Approximate
remaining exam
time: 00:00:00
The Exam is Over.

Document Date

Evaluator Examiner Page: Trying to Restart an Exam that has ended

Remaining Exam Time Business Services

User Services

Input Page:

```

Evaluator
Examinator HTML
Frame set
    
```

Output Page:

```

HTML Frame:
Exam Status
(Remaining Time)
Recalls Exam
StatusFrameServlet
every 30 secs
    
```

Data Services

Welcome Page: Logged in, Ready to See Exam Results

Welcome WEUSI-PURYEAR, KOFL - Netscape			
File Edit View Go Favorites Help			
de=BUS%201188-02			
Welcome to Evaluator WEUSI-PURYEAR, KOFL.			
~~~~~			
Exams available for you to take:			
Course	Exam Name	Available Until	Duration
~~~~~			
Exam results available for you to view:			
Course:	Exam Name:	Last Given On:	
BUS 118B-02	Midterm	1999-04-08 18:00:00.0	

Exam Results - Netscape

File Edit View Go Home Back Forward Reload Stop Print

http://cs1ab61.engr.sjsu.edu/servlet/edu/

BUS 118B-02 Exam Results

Exam: Midterm

Student: [REDACTED]

Grade: 80.0%

0.0 point(s)	FALSE 0.0%
True / False Question 1	TRUE 100.0%
MIS were conceptually similar to EIS in terms of the scope of the information they provide	Question Score: 0.0 Points

Exam Results - Netscape	
Back Forward Home Search Netscape Stop N	
http://www.edutek.edu/evaluator/ResultsServlet	
<p>0.0 point(s)</p> <p>Multiple Choice</p> <p>Question 40</p> <p>Strategic models do all the following except:</p>	<p>accomplish organizational objectives 0.0%</p> <p>help management determine the policies for using organizational resources 0.0%</p> <p>help management allocate and control organizational resources 100.0%</p> <p>help management determine the objectives of the organization 0.0%</p> <p>Question Score: 0.0 Points</p>
<p>1.0 point(s)</p> <p>Multiple Choice</p> <p>Question 39</p> <p>The DSS dialog consists of all the following except:</p>	<p>all of the above 0.0%</p> <p>the presentation language 0.0%</p> <p>the database query language 100.0%</p> <p>the knowledge base 0.0%</p> <p>the action language 0.0%</p> <p>Question Score: 1 Point</p>
	they provide data

Exam Results Page: Top

Exam Results - Netscape

Back Forward Reload Home Stop Reload

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<p>True / False</p> <p>Question 2</p> <p>"EIS eliminate the need for other types of organizational computing, such as transaction processing systems, management information systems, and decision support systems."</p>	<p>FALSE</p> <p>100.0%</p> <p>TRUE</p> <p>0.0%</p> <p>Question Score: 1 Point</p>
<p>TOTAL</p> <p>SCORE</p>	<p>40.0 / 50.0 = 80.0%</p>

Done

User Services

Input Page:

HTML Page:
Welcome to
your available exam
results.

Output Page:

HTML Page:
Exam Results

Exam Results Business Services

Data Services

```

public class ResultServer {
    private ResultsTable resultsTable;

    public ResultServer(ResultsTable resultsTable) {
        this.resultsTable = resultsTable;
    }

    public ResultsTable getResultsTable() {
        return resultsTable;
    }

    public void setResultsTable(ResultsTable resultsTable) {
        this.resultsTable = resultsTable;
    }

    public ResultsTable getResultsTable() {
        return resultsTable;
    }

    public void setResultsTable(ResultsTable resultsTable) {
        this.resultsTable = resultsTable;
    }
}

```

```

public class ResultsTable {
    private ResultsTable resultsTable;

    public ResultsTable(ResultsTable resultsTable) {
        this.resultsTable = resultsTable;
    }

    public ResultsTable getResultsTable() {
        return resultsTable;
    }

    public void setResultsTable(ResultsTable resultsTable) {
        this.resultsTable = resultsTable;
    }
}

```

```

public class QuestionObject {
    private int questionID;
    private String questionText;
    private int questionType;
    private String[] questionOptions;
    private boolean questionCorrect;

    public QuestionObject(int questionID, String questionText, int questionType, String[] questionOptions, boolean questionCorrect) {
        this.questionID = questionID;
        this.questionText = questionText;
        this.questionType = questionType;
        this.questionOptions = questionOptions;
        this.questionCorrect = questionCorrect;
    }

    public int getQuestionID() {
        return questionID;
    }

    public String getQuestionText() {
        return questionText;
    }

    public int getQuestionType() {
        return questionType;
    }

    public String[] getQuestionOptions() {
        return questionOptions;
    }

    public boolean getQuestionCorrect() {
        return questionCorrect;
    }

    public void setQuestionID(int questionID) {
        this.questionID = questionID;
    }

    public void setQuestionText(String questionText) {
        this.questionText = questionText;
    }

    public void setQuestionType(int questionType) {
        this.questionType = questionType;
    }

    public void setQuestionOptions(String[] questionOptions) {
        this.questionOptions = questionOptions;
    }

    public void setQuestionCorrect(boolean questionCorrect) {
        this.questionCorrect = questionCorrect;
    }
}

```

```

public class AnswerObject {
    private int answerID;
    private String answerText;
    private boolean answerCorrect;

    public AnswerObject(int answerID, String answerText, boolean answerCorrect) {
        this.answerID = answerID;
        this.answerText = answerText;
        this.answerCorrect = answerCorrect;
    }

    public int getAnswerID() {
        return answerID;
    }

    public String getAnswerText() {
        return answerText;
    }

    public boolean getAnswerCorrect() {
        return answerCorrect;
    }

    public void setAnswerID(int answerID) {
        this.answerID = answerID;
    }

    public void setAnswerText(String answerText) {
        this.answerText = answerText;
    }

    public void setAnswerCorrect(boolean answerCorrect) {
        this.answerCorrect = answerCorrect;
    }
}

```

```

public class ExamObject {
    private int examID;
    private String examName;
    private int examDuration;
    private QuestionObject[] examQuestions;

    public ExamObject(int examID, String examName, int examDuration, QuestionObject[] examQuestions) {
        this.examID = examID;
        this.examName = examName;
        this.examDuration = examDuration;
        this.examQuestions = examQuestions;
    }

    public int getExamID() {
        return examID;
    }

    public String getExamName() {
        return examName;
    }

    public int getExamDuration() {
        return examDuration;
    }

    public QuestionObject[] getExamQuestions() {
        return examQuestions;
    }

    public void setExamID(int examID) {
        this.examID = examID;
    }

    public void setExamName(String examName) {
        this.examName = examName;
    }

    public void setExamDuration(int examDuration) {
        this.examDuration = examDuration;
    }

    public void setExamQuestions(QuestionObject[] examQuestions) {
        this.examQuestions = examQuestions;
    }
}

```

```

public class StudentObject {
    private int studentID;
    private String studentName;
    private String studentEmail;

    public StudentObject(int studentID, String studentName, String studentEmail) {
        this.studentID = studentID;
        this.studentName = studentName;
        this.studentEmail = studentEmail;
    }

    public int getStudentID() {
        return studentID;
    }

    public String getStudentName() {
        return studentName;
    }

    public String getStudentEmail() {
        return studentEmail;
    }

    public void setStudentID(int studentID) {
        this.studentID = studentID;
    }

    public void setStudentName(String studentName) {
        this.studentName = studentName;
    }

    public void setStudentEmail(String studentEmail) {
        this.studentEmail = studentEmail;
    }
}

```

```

public class ScoreTable {
    private int scoreID;
    private int studentID;
    private int examID;
    private double score;

    public ScoreTable(int scoreID, int studentID, int examID, double score) {
        this.scoreID = scoreID;
        this.studentID = studentID;
        this.examID = examID;
        this.score = score;
    }

    public int getScoreID() {
        return scoreID;
    }

    public int getStudentID() {
        return studentID;
    }

    public int getExamID() {
        return examID;
    }

    public double getScore() {
        return score;
    }

    public void setScoreID(int scoreID) {
        this.scoreID = scoreID;
    }

    public void setStudentID(int studentID) {
        this.studentID = studentID;
    }

    public void setExamID(int examID) {
        this.examID = examID;
    }

    public void setScore(double score) {
        this.score = score;
    }
}

```

Lost CORBA Connection Errors Can be Recovered From by Reloading the Page