COMPARATIVE STUDY BETWEEN JAVA AND C++ PROGRAMMING LANGUAGES

by

Nur Liyana Binti Hj. Hamdan
4068

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Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
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Approved by,

(Ms. Eliza Mazmee Mazlan)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
July 2006

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original wok contained herein have not been undertaken or done by unspecified sources or persons.

NUR LIYANA HAMDAN (4068)

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ABSTRACT

This final report represents a proposed project for comparing the use of language features in C++ and Java programming languages. The key idea of this study will contribute to a better accuracy of decision making as well as better understanding of both C++ and Java languages. It also will provide new and more detailed information about the features, design and the implementation of using the respective languages. At the end of the project, the thing that I want to accomplish is to be able to help and guide software developers and programmers in the decision making of choosing the best and the most suitable programming languages in developing software or programs and in this case, between the two programming languages, Java and C++ languages.

CHAPTER 1
INTRODUCTION

1.1 Background of Study

This project is about exploring and also researching the features and other unique characteristics between C++ and Java programming languages. The idea held in this report is to prove that we can have a significant reduce in time taken to build a single program if we know what language suits us best in developing the program. This report basically will distinguish and compare between C++ and Java programming languages and will help us to choose the most suitable language to be used based on the features and requirements needed in the desired program or software. This report will also provide new information about the vast knowledge of both C++ and Java language.

It is well known that we have so many medium or so many programming languages to develop any kind of programs or software that we wish for. Normally, the programmer or the developer will develop those assigned task depending on what language they are proficient at. But unfortunately, they cannot do so if the user or client has their own preferences in selecting the programming language whichever suits their requirements. Here in this report, the choices are only between C++ and Java and the research will then recommend which programming language has clear advantages over the other one if we are to develop any program.

In the objective to achieve the goal of the project, this report will also discuss some of the issues and points related to demonstrating the advantages and also the disadvantages of using such programming language.

1.2 Problem Statement

When it comes to the pros and cons of various programming languages, programmers and software developers alike are usually highly narrow-minded. In contrast, only relatively little high-quality objective information is available about the relative merits of different languages. The scientific and engineering literature provides many comparisons of programming languages in different ways and with different restrictions.

The idea of studying this comparison between C++ and Java emerged due to some advantages and disadvantages or limitations in both programming languages. Besides that, the disadvantages will surely lead to inefficient time-consumptions. Both programming languages (C++ and Java) have their own unique advantages and disadvantages. From the advantages and disadvantages discovered and studied, the problem and predicament in choosing the most suitable programming language and in this case, both Java and C++ can be solved and an easier guideline can be provided to the software developers and the programmers in developing programs or software that meets with the users' requirements.

1.3 Objectives

1. To eliminate the problem of inefficient platforms used due to lack of judgments of better platforms that can be used. This can be achieved through the use of guidelines in the decision making of the more suitable programming language (Java and C++) in developing software or programs developed in the later stage of the project

2. To improve practicality by offering better understanding and let the programmers have better sight of selections plus enhancing programmers' performance based on metrics and parameters like:
   - Programmers' capabilities with the said programming languages (Java and C++)
   - The different tasks and different work conditions
   - The memory consumption required by the said programming languages (Java and C++)
   - The work time (in terms of designing, writing codes and testing)

3. To perform a research and development of both programming languages, C++ and Java respectively and provide guidelines in the decision making for the programmers and software developers in choosing the most suitable programming language to develop programs or software

1.4 Scope of Study

The scope of this study is to make comparison between the two respective programming languages, Java and C++. Advantages and disadvantages of both the programming languages (Java and C++) are determined from the findings through the method of literature review. From these findings, it will be a base for the development of the system where it will guide the programmers or software developers in choosing the most suitable programming language (Java and C++) for the implementation programs or even software. Analysis, design and implementation of the system will be included in the overall project for Final Year Project report.

CHAPTER 2
LITERATURE REVIEW

As mentioned in the Objective and Scope of Study section, this proposed project will look into the comparison of properties for both of the languages in terms of multiple inheritance, memory management, exceptions, threads, operator overloading, templates, labeled breaks and continues and other non-trivial issues.

A literature review is an evaluation of the most significant and relevant research materials written and published on a research topic.
Leedy (1997) elaborates on eight (8) specific benefits that can result from literature review efforts:

1. It can reveal investigations similar to your own and it can show how other researchers handled methodological and design issues
2. It can describe methods of dealing with problem situations that may be similar to difficulties that you are facing
3. It can reveal to you sources of data that you may not have known existed
4. It can introduce you to important research personalities whose work and collateral writings you may not have known
5. It can help you see your own study in historical and associational perspective and in relation to earlier approaches to the same problem
6. It can provide you with new ideas and approaches that may not have occurred to you
7. It can help you evaluate your own research efforts by comparing them with the similar efforts of others
8. It can increase your confidence in selected topic if you find that others have an interest in this topic and have found value in investing time, efforts and resources into its study

When it comes to the pros and cons of various programming languages, programmers and computer scientists alike are usually highly opinionated. In contrast, only relatively little

high-quality objective information is available about the relative merits of different languages. The scientific and engineering literature provides many comparisons of programming languages, in different ways and with different restrictions [1]. Some are benchmarks comparing a single implementation of a certain program in either language for expressiveness or resource consumption [2]. Such comparisons are useful, but extremely narrow and hence always slightly dubious: Is each of the implementations adequate? Or could it have been done much better in the given language? Furthermore, the programs compared in this manner are sometimes extremely small and simple.

Some are empirical comparisons based on several and larger programs. They discuss for instance defect rates or productivity figures. The problem of these comparisons is lack of homogeneity: Each language is represented by different programs and it is unclear what fraction of the differences (or lack of differences) originates from the languages as such and what fraction is due to different programmer backgrounds, different software processes, different application domains, different design structures, etc [3].

Java is a well-designed object-oriented language which provides powerful programming features. Over and above that, its networking and distribution facilities make Java increasingly important as a programming language for 'real' problems rather than for making Web pages more appealing. Whereas many applications are being written in Java there are still many software components, mainly in form of libraries, implemented in C++, which solve numerous standard tasks such as protocol handling and graphics. It would be wasteful to have to re-implement those libraries in Java. What is needed is an automatic method by which the gap between Java and C++ is bridged, and existing C++ libraries can be transparently used from Java applications. Language interoperability between two different programming environments involves the crossing of domain boundaries. In fact, there are two different types of domains that are being crossed when interfacing C++ and Java. A language domain comprises of all the entities written in the same programming language. Crossing the domain language boundary between C++ and Java means that there must be a method of remodeling the language features of one domain in the other [4].

We need to take into account all of the features and the advantages that these programming will offer before selecting the platform. These are all I will address in my Final Year Project. As for now, I will just state a few or presumably just a rough idea of comparing Java and C++ programming languages.

The advantages and disadvantages of **Java** programming language are cited below:

Major advantages

1. Java is simple

Java is considered a much simpler and easy to use object-oriented programming language when compared to the popular programming language, C++. Partially modeled after C++, Java has replaced the complexity of multiple inheritance in C++ with a simple structure called interface, and also has eliminate the use of pointers.

The reason why Java is much simpler than C++ is because Java uses automatic memory allocation and garbage collection where else C++ requires the programmer to allocate memory and to collect garbage. Also, the number of language constructs in Java is small for such a powerful language. The clean syntax makes Java programs easy to write and read.

Java is Object-oriented programming models the real world. Everything in the world can be modeled as an object. For example, a circle is an object, a person is an object, and a window's icon is an object. Java is object-oriented because programming in Java is centered on creating objects, manipulating objects, and making objects work together.

Object-oriented programming provides greater flexibility, modularity and reusability. Java has helped object-oriented technology enter the mainstream of computing, with its simple and clean structure that allows the programmer to write easy to read and write programs.

2. *Java is robust*

Robust means reliable and no programming language can really assure reliability. Java puts a lot of emphasis on early checking for possible errors, as Java compilers are able to detect many problems that would first show up during execution time in other languages. Java eliminates certain types of programming constructs in other languages that are prone to errors. For instance, Java does not support pointers, which eliminates the possibility of overwriting memory and corrupting data. Java has a runtime exception-handling feature to provide programming support for robustness, and can catch and respond to an exceptional situation so that the program can continue its normal execution and terminate gracefully when a runtime error occurs.

3. *Java is interpreted*

An interpreter is needed in order to run Java programs. The programs are compiled into Java Virtual Machine code called byte code. The byte code is machine independent and is able to run on any machine that has a Java interpreter. Normally, a compiler will translate a high-level language program to machine code and the code is able to only run on the native machine. If the program is run on other machines, the program has to be recompiled on the native machine. For example, if you compile a C++ program in Windows, the executable code that is generated by the compiler can only be run on a Windows platform. With Java, the program need only be compiled once, and the byte code generated by the Java compiler can run on any platform.

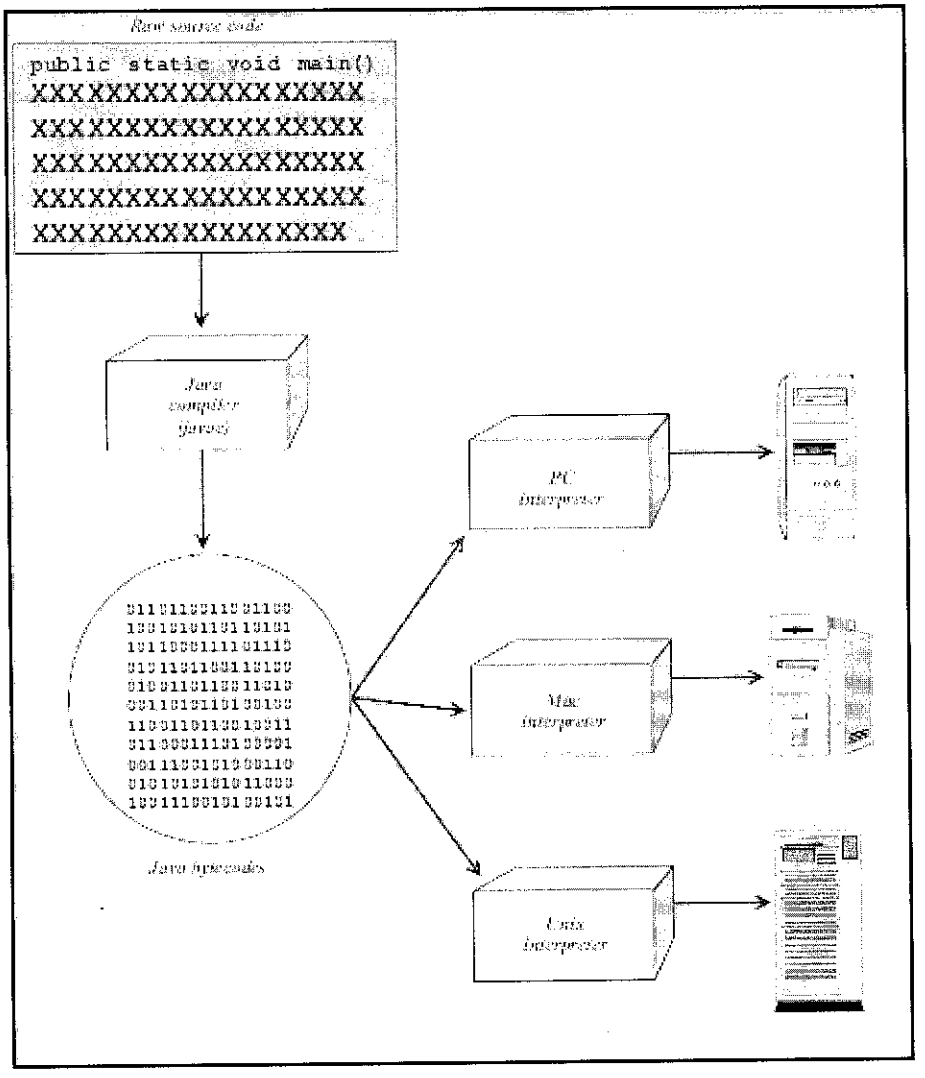

Figure 2.1: Java Can Be Run on Any System

4. *Java is dynamic*

The Java programming language was designed to adapt to an evolving environment. New methods and properties can be added freely in a class without affecting their clients. Also, Java is able to load classes as needed at runtime. As an example, you have a class called 'Square'. This class has a property to indicate the color of the square, and a method to calculate the area of the square. You can add a new property to the 'Square' class to indicate the length and width of the square, and a new method to calculate the perimeter of the square, and the original client program that uses the 'Square' class remains the same.

Major disadvantages

1. Java is slow

Like any programming language, Java is not without drawbacks. As mentioned earlier, one of the advantages of Java is, it is an interpreted language, so programs written in Java won't be speed demons. Still, for most programs that students write, speed is secondary. With ever-faster computers available at bargain prices, Java should be fast enough for all but the most time-intensive programs. Unlike natively compiled code, which is a series of instructions that correlate directly to a microprocessors instruction set, an interpreter must first translate the Java binary code into the equivalent microprocessor instruction. Obviously, this translation takes some amount of time and, no matter how small a length of time this is, it is inherently slower than performing the same operation in machine code.

2. Java is immature

Java is relatively immature. Although the language itself is unlikely to change dramatically, we can expect significant changes in the Java API and associated technology. Still, C++ has been in a state of almost continuous change since it was created--the official standard isn't expected for another year or two--but that hasn't stopped industry and academia from adopting it.

Other problems stem from Java's youth. For one thing, Java isn't available on all platforms. Although Java will likely spread to more as time goes on, it's unlikely to be implemented on older platforms. That will cause problems for institutions that lack funds for hardware and software upgrades. Still, that barrier should be only a temporary one.

Meanwhile, the advantages and disadvantages of **C++** programming language are as below:

Major Advantages

1. C++ is the object-oriented successor to C

Object-oriented, or OO, programs are the next step beyond structured programming. OO programs are built out of objects, which are packages of data and functions collected into discrete units. There are many libraries of objects available that make writing programs as simple as pulling together a collection of program "building blocks" (at least in theory). For example, there are many GUI and database libraries that are implemented as collections of objects.

2. C++ has extra features

C++ is the subject of controversy, especially in the game development community. There are features of C++, like virtual functions, that add an extra layer of decision-making to function calls, and critics are quick to point out that C++ programs can be larger and slower than C counterparts. C++ advocates point out, however, that coding the equivalent of a virtual function in C requires the same overhead.

Major disadvantages

1. C++ has no concept of modules

For truly large programs, it is impossible for one programmer to hide his private names (such as class names) from another programmer. This causes name conflicts, which the compiler may or may not detect until a system is installed.

2. C++ has ambiguous syntax

The grammar of C++ is inherently ambiguous. As a result, parsing C++ is essentially impossible, though one can write parsers which closely approximate what Bjarne had in mind when he created the language. For example, the following C declaration:

TYPE (*EXPR)() - could be interpreted as either, declaring EXPR to be a pointer to function returning type TYPE, or it could be to take EXPR, dereference it (or apply operator *), cast the resulting expression to type TYPE, then use the result as a function

to call (or to apply operator ()()). As you can see, there are two perfectly valid interpretations of the same syntactic form. The reason for declaring variables in programming languages was to avoid the problems that could crop up in languages.

3. C++ has limited syntactic

C++ provides a rich variety of features, but syntactic limitations keep these features from being usable in a lot of contexts. As a result, C++ features are more ad hoc than orthogonal. For example, it is possible to have an object, and object which needs a constructor (for initialization), and an object which needs a constructor which takes arguments. It is also possible to declare an array of objects, an array of objects which take constructors, but not an array of objects which need constructors that take arguments. The method for initializing static class members and the whole issue of initialization of file-level objects exposes just how weak the UNIX compilation environment actually is. This is not a fault of C++ per se, but C++ really stretches its environment at its weakest points.

The differences between the C++ and Java programming languages can be traced to their heritage [11].

C++ was created to add statically-typed object-oriented language features to the C programming language. C is a procedural programming language that was designed for efficient execution at the machine level. As such, both C and C++ provide good support for both application and systems programming.

Java was created initially to support network computing on embedded systems. Java was designed to address several qualities not present in C++ at the language level: portable, robust, secure, multi-threaded and distributed. The syntax of Java was chosen to be familiar to C programmers, but direct compatibility with C was not maintained. Java also was specifically designed to be simpler than C++.

The different goals in the development of C++ and Java resulted in different principles and design tradeoffs between the languages.

C++	**Java**
execution efficiency	developer productivity
trusts the programmer	protects the programmer
arbitrary memory access possible	memory access only through objects
concise expression	explicit operation
can arbitrarily override types	type safety
procedural and object-oriented	object-oriented
redefine operators	meaning of operators immutable
feature rich	easy to use

Table 2.1: Principles and Design Tradeoffs between Java and C++

CHAPTER 3

METHODOLOGY

In this section, I will discuss the main methodology for this project which is project planning, analysis of the project and system, the design of the system and lastly the implementation of the system. The details of each of this method will be discussed in the later pages.

For the development of this project, RAD (Rapid Application Development) will be used considering the time frame given is quite short. This development method was chosen based on categories that indicate the suitability of adopting this development method.

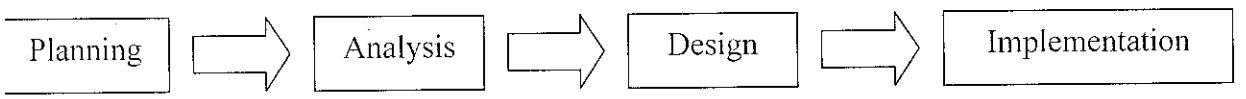

Figure 3.1: Methodology

For the first two parts of the methodology (Planning and Analysis), I will explicate the details below meanwhile for the latter two parts (Design and Implementation) will be explained in the results and discussion chapter.

3.1 Tools required

Specifications of the tools required for the Final Year Project (FYP) are:

Hardware Specifications

- At least 256MB RAM, 40GB HDD for Personal Computer (PC) and Laptop

Software Specifications

- Search Engines - Yahoo, Google, MSN, Wikipedia and etc.
- Web Browsers – Mozilla Firefox, Internet Explorer, Opera and etc.
- Operating System (OS) – Microsoft Windows 98, 2000, XP
- Programming Software – Microsoft Visual Studio 2005

3.2 Planning

In the early development of the system, planning is one of the most important and vital part in ensuring the success of the development of the system. In the project planning, requirements gathering are needed. Requirements gathering encompass all of the tasks that go into the instigation, scoping and definition of a new or altered system. Requirements gathering is an important part of the system design process, whereby requirements engineers and business analysts, along with systems engineers or software developers, identify the needs or requirements of a client. Once the client's requirements have been identified, the system designers are then in a position to design a solution.

In this project's requirements gathering, literature review is implemented. A literature review is an evaluation of the most significant and relevant research materials written and published on a research topic. Literature review is helpful in the development of the system as a way to provide me with new ideas and approaches that may not have occurred to me. Other than that, by evaluating literature review as a method of requirements gathering, my confidence in selected topic will increase if I find that others have an interest in this topic and have found value in investing time, efforts and resources into the study. By implementing literature review also, I can describe the methods of dealing with problem situations that may be similar to the difficulties that I will be facing later on.

For this project, information gathered from my findings and of course from literature review will be a base of the questions that will be developed for the system in determining which programming languages (Java and C++) suits best for the programmer.

3.3 Analysis

For the next step of the methodology in developing the to-be system for the Final Year Project Part II, analysis is applied. Analysis is the abstract separation of a whole into its constituent parts in order to study the parts and their relations and it is also an investigation of the component parts of a whole and their relations in making up the whole system.

Since I will be developing the questions for the system in determining which programming languages (Java and C++) that suits best for the programmers and software developers, I have to analyze the importance and significance of each of the questions to make a sense out of the system and also to achieve the objectives stated in the former pages of this report. Information gathered needs to be analyzed primarily to come up with a detailed discussions and results.

From the questions developed, I then will have to categorize them into several elements:

- Literacy of the programmers or software developers in both respective programming languages and also
- The experience of the programmers in using and applying the programming languages in developing systems or software.

From this analysis, I hope that programmers and software developers will be able to identify which programming languages suit them better and in this case Java and C++. Therefore, from this project, programmers and software developers will be able to develop programs or systems using the programming language that has been identified as the most suitable programming language for them.

CHAPTER 4

RESULTS AND DISCUSSIONS

In developing the system that can determine and in a way help programmers choose which programming languages and in this case, Java and C++ programming languages are suitable for them to apply when developing systems or programs, questionnaires are important to solve the problem. By developing a prototype of a decision support system, based on the questionnaires answered by the programmers, the system should be able to help programmers decide which programming language (Java or C++) is suitable in developing a certain program or system.

4.1 Design

For this final report, I will develop questionnaires in accordance with my findings from literature review for the system and by assuming that the programmers are familiar with the mentioned programming languages (Java and C++). In this design phase, the questionnaires that will be developed are targeted to programmers and software developers and particularly those with experience and skills in the respective programming languages: Java and C++. Based from the questions, generated answer from the system indicating that the programming language is more suitable for the programmers and software developers will be formulated.

Sample of the questions are included in the **Appendix 1-1**.

4.1.1 System Architecture

After much enhancements and alterations to the system, finally the system looks like below. Altogether, there are eight (8) forms in the system. Each of the forms will be shown along with the steps in guiding the user into using the system and also the significance to how each of the questions is grouped together.

As mentioned in the previous pages, the system essentially looks into the literacy of the programmers in using the respective programming languages and also the experience of the programmers and software developers in applying the respective programming languages in the development of systems and software.

First Page

The first page is basically the main page. The first page shows the instructions given to the programmers in answering the questions. Fundamentally, the first page seeks the experience of the programmers in using and applying the said programming languages: Java and C++. The questions also inquire about the number of years the programmers have been using the system, the level of experience of the programmers, the purpose of use of the programming languages and others.

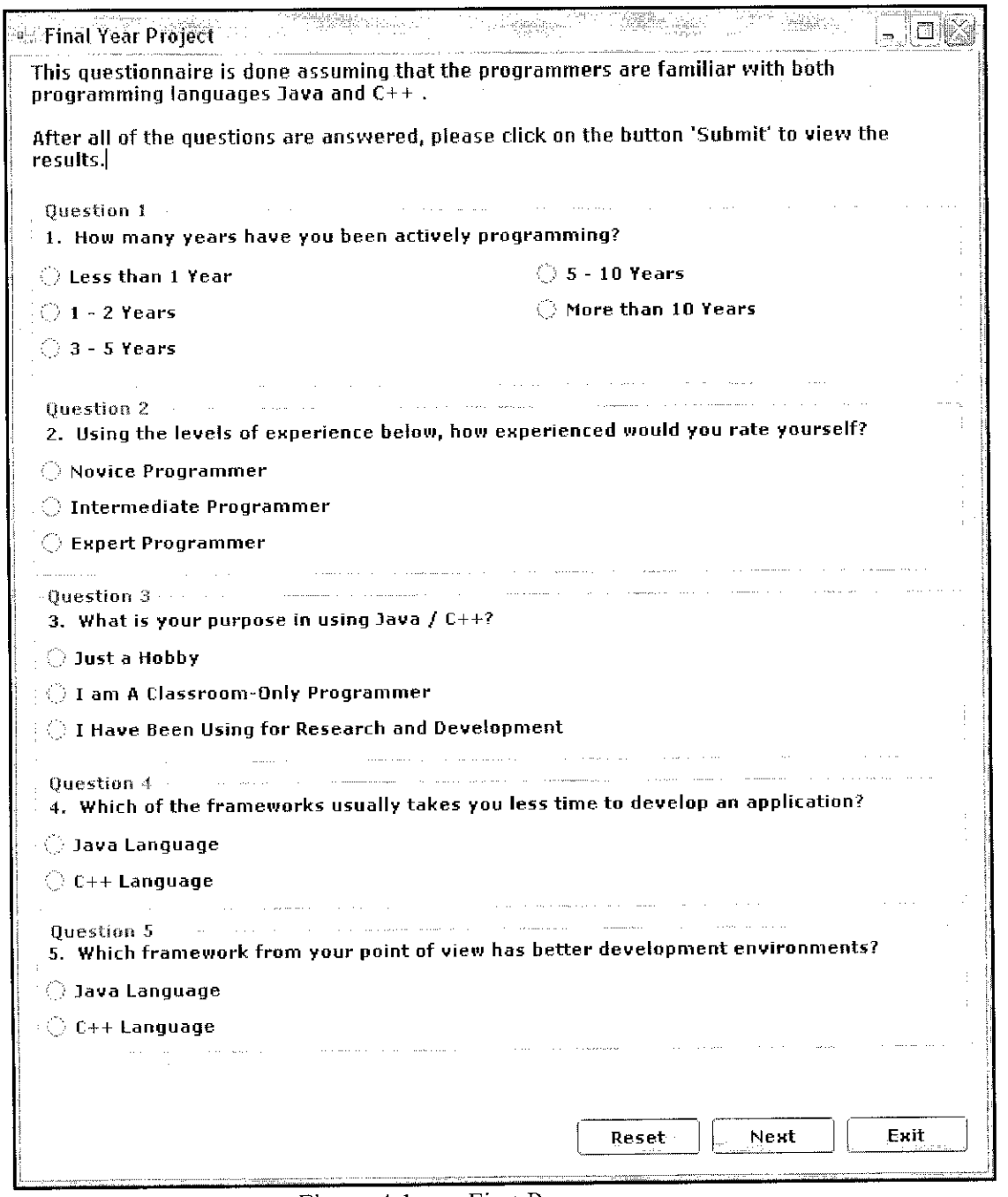

Figure 4.1: First Page

Instructions are read and the questions answered. 'Reset' button is clicked to reset the answers and all of the radio buttons will then be cleared. To exit or quit from the system, the 'Exit' button is clicked and the user will then be prompted with a pop-up window indicating whether the user really wishes to quit from the system. Once all of the questions are answered, 'Next' button is clicked.

Second Page

This second page basically questions and seeks answers from programmers about the complexity, features of Java programming language. This page also questions the programmers about the level of security of Java programming language. The last question in this page is the start of the many questions about the features of Java programming language with respect of the different topics and sub-features.

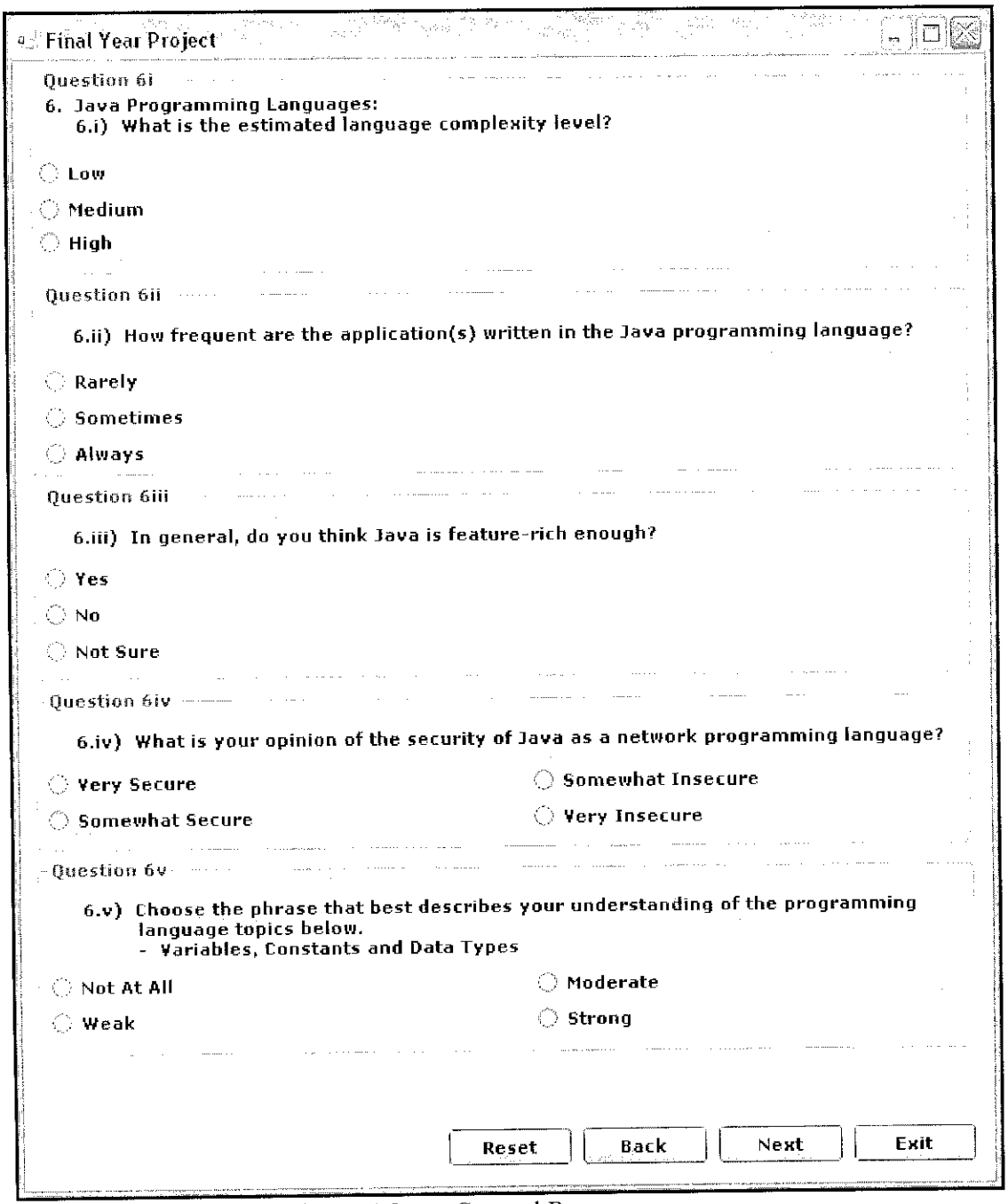

Figure 4.2: Second Page

The procedures of this page are the same as the first one in addition with a 'Back' button if the user wishes to view the previous page.

Third Page

The third page is where all of the basic features of Java programming language are inquired. Features like sequence, loop and iteration, if-else decision, methods and procedures, arrays, inheritance and polymorphism are all displayed in the third page. This page is intended to seek the level of strength, skills and knowledge of the programmers in these topics.

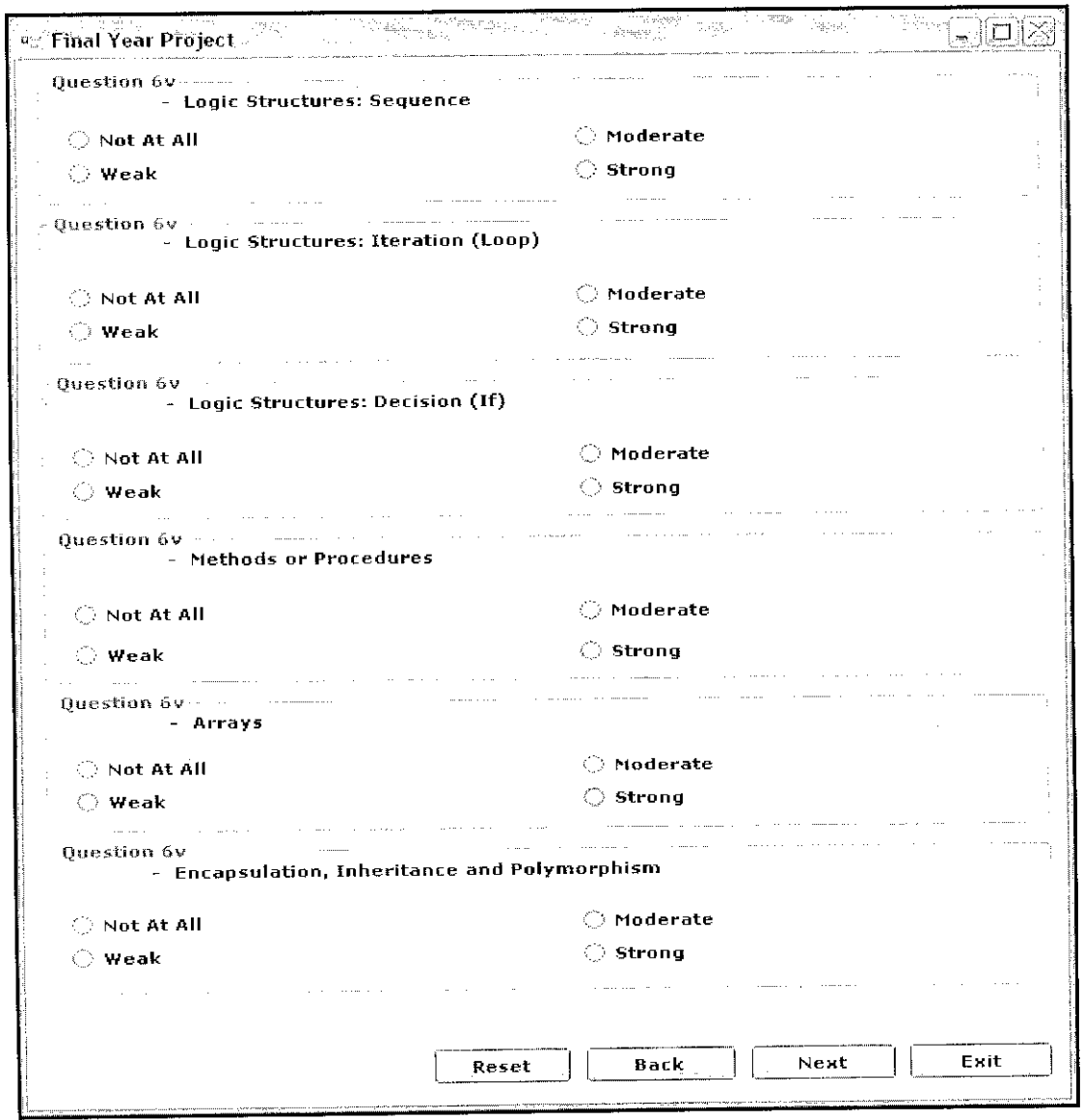

Figure 4.3: Third Page

The procedures of this page are the same as the first one in addition with a 'Back' button if the user wishes to view the previous page.

Fourth Page

For the fourth page, the first two questions in this page are to obtain the level and quality of errors in Java programming language. Meanwhile the latter questions are designed to obtain information about the skill, knowledge and experience of the programmers in applying C++ programming language.

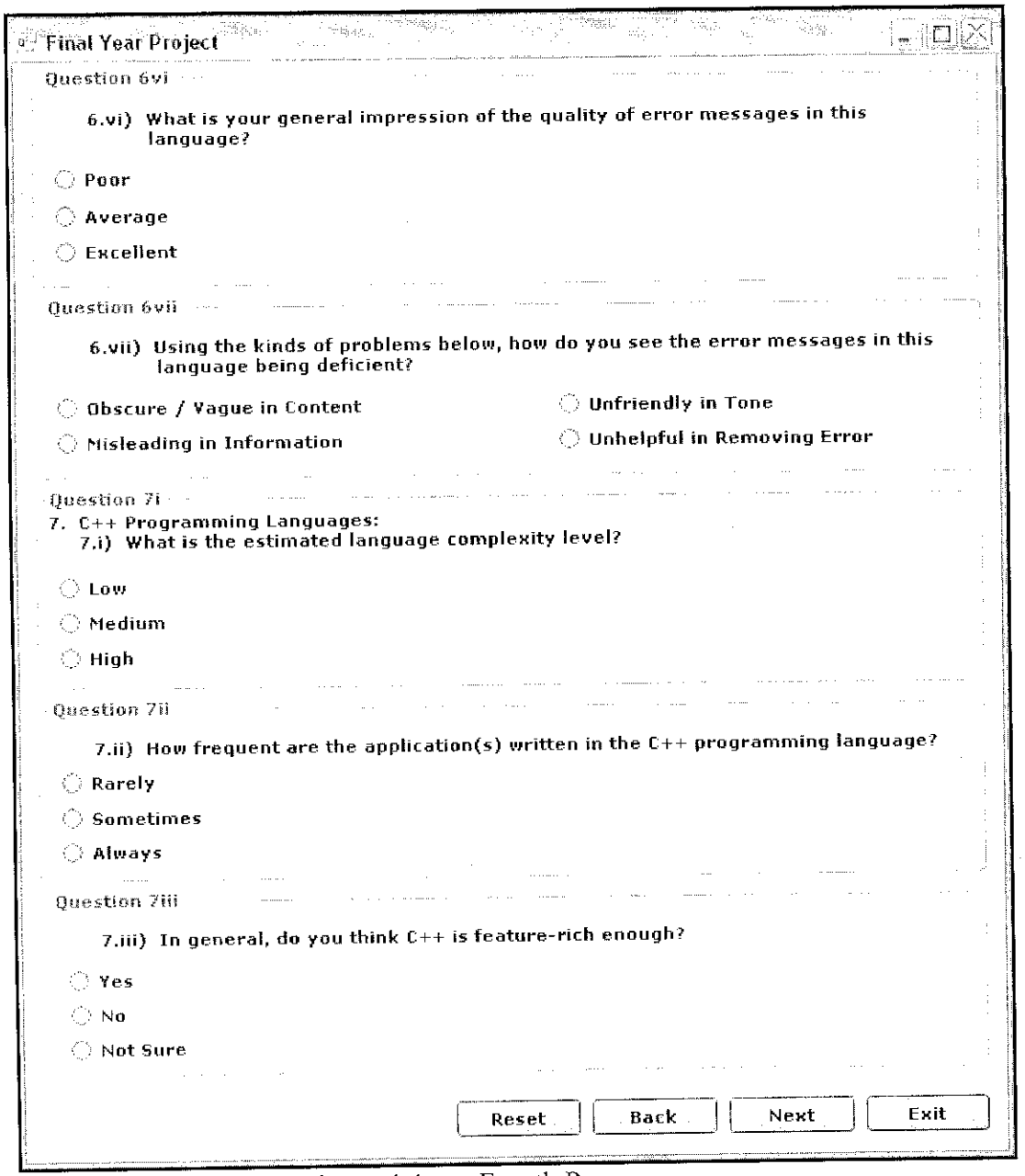

Figure 4.4: Fourth Page

The procedures of this page are the same as the first one in addition with a 'Back' button if the user wishes to view the previous page.

Fifth Page

This form represents the questions about the skill, knowledge of the programmers with regards to the features of C++ programming language in terms of variables, constants, sequence, if-else decision, loop and iterations, methods and procedures. Note that the questions in Java's perspectives is as the same as C++'s perspectives in the later pages.

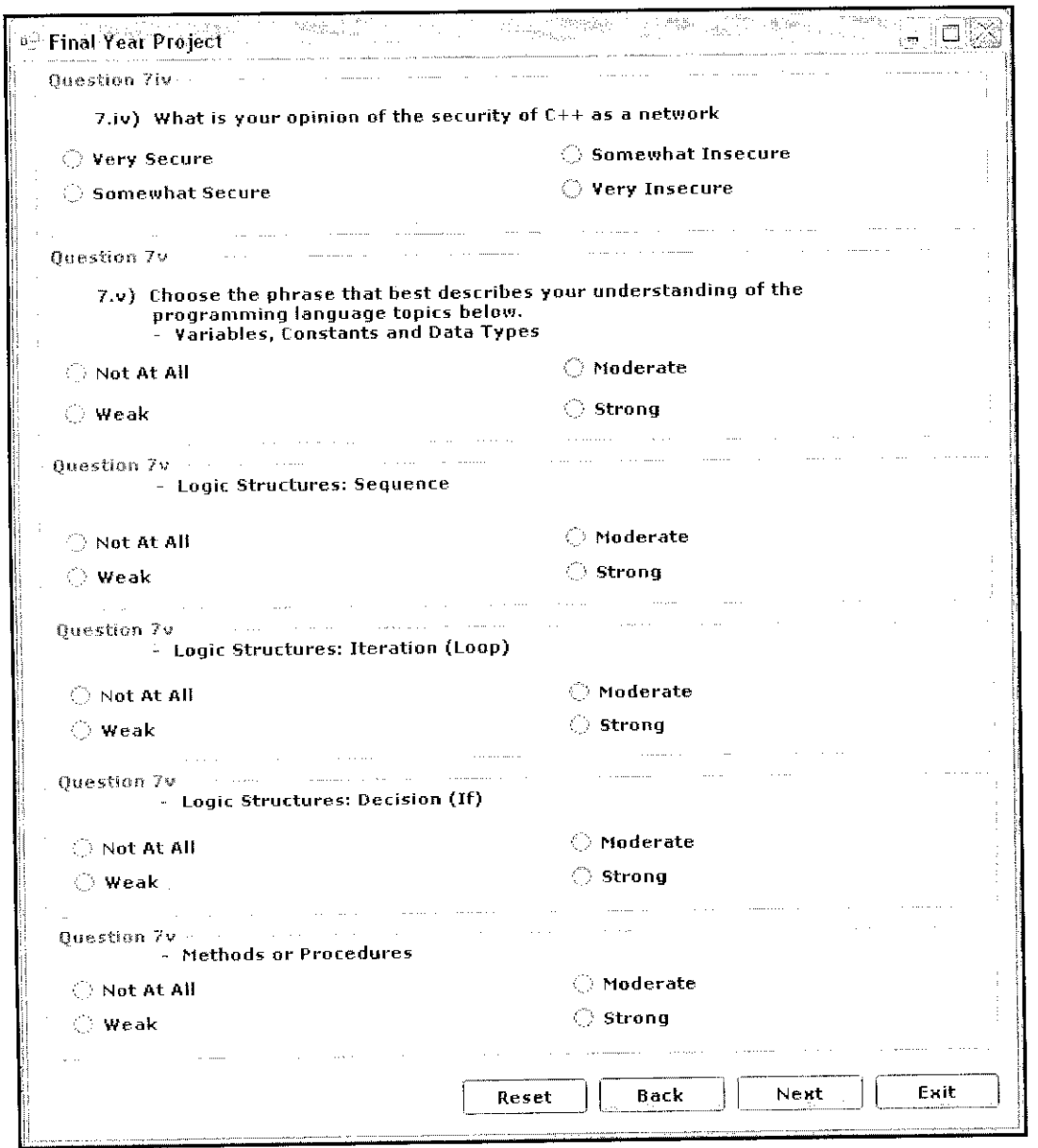

Figure 4.5: Fifth Page

The procedures of this page are the same as the first one in addition with a 'Back' button if the user wishes to view the previous page.

Sixth Page

The last page for the questions basically deals again with the features of C++ programming language plus the level and the quality of error controls in C++ programming language.

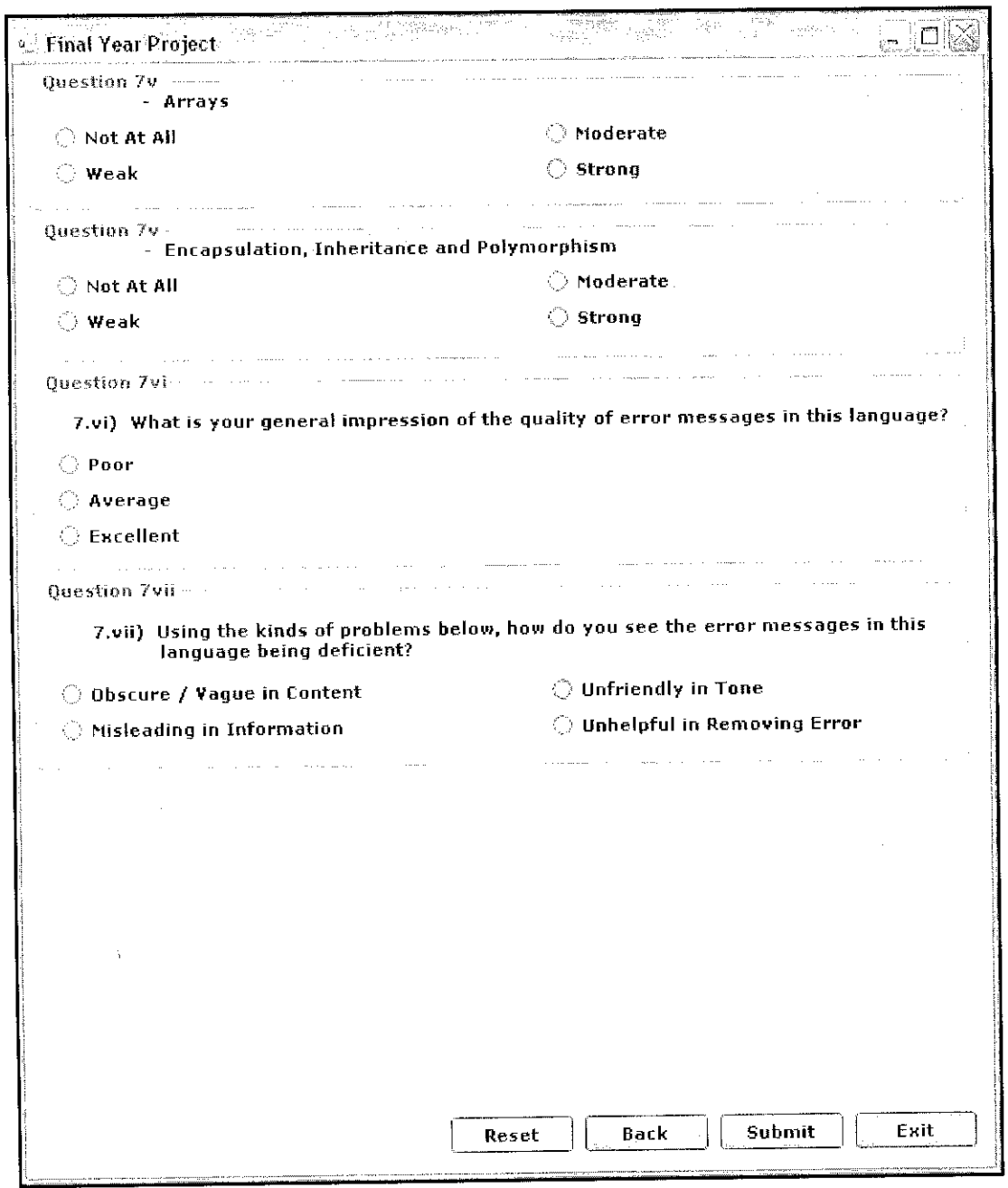

Figure 4.6: Sixth Page

The procedures of this page are the same as the first one in addition with a 'Back' button if the user wishes to view the previous page. Once the user is done and is satisfied with the answers in the previous pages, button 'Submit' is clicked so that the system will generate the answer and indicates whether the programmer is most suitable with which programming language and in this case Java and C++ programming languages.

Seventh Page

From the answers calculated and generated, the system will then show this page if the user is more prone to using Java programming languages in developing programs or software.

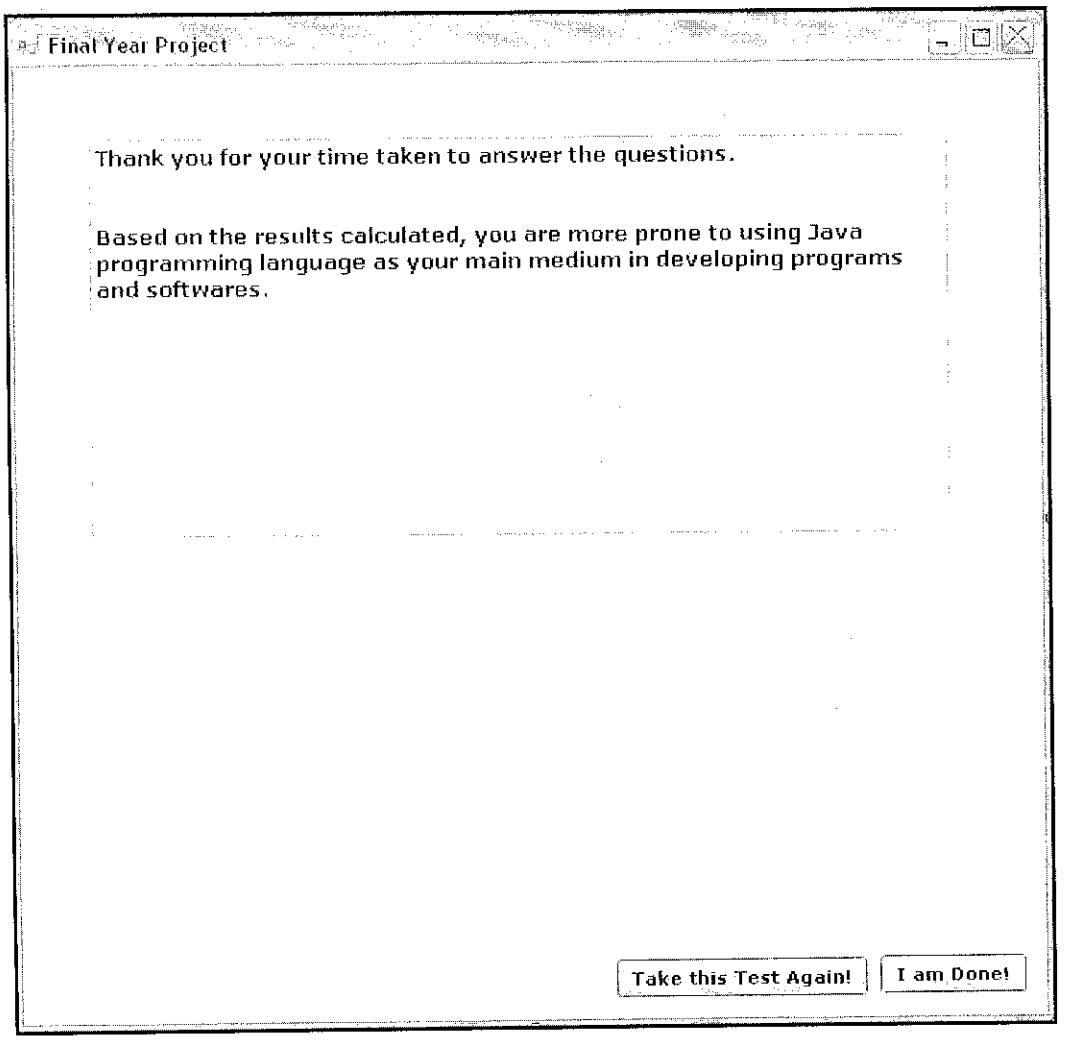

Figure 4.7: Seventh Page

Once the user is done and wishes to quit from the system, click on the 'I am Done!' button and a pop-up window will appear indicating whether the user really wishes to quit from the system. 'Take this Test Again!' button is clicked if the user wishes to take the test again and the page will be redirected back to the first page.

Eighth Page

If the result generated from the system is more prone to C++ programming language, then this page will be shown.

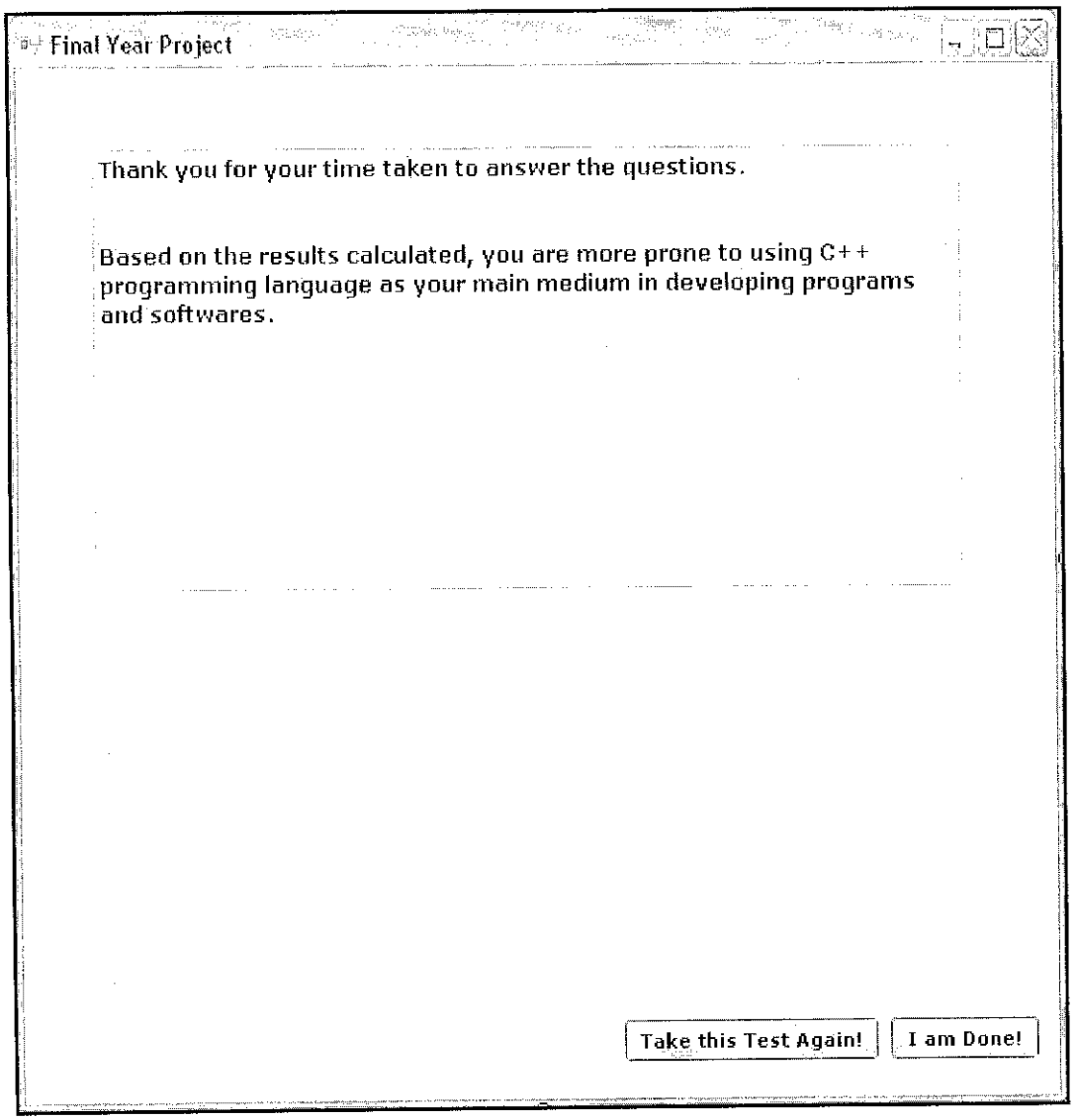

Figure 4.8: Eighth Page

Once the user is done and wishes to quit from the system, click on the 'I am Done!' button and a pop-up window will appear indicating whether the user really wishes to quit from the system. 'Take this Test Again!' button is clicked if the user wishes to take the test again and the page will be redirected back to the first page.

4.2 Implementation

For the implementation phase, to ensure the functionality of the system, several testing methods are done and conducted. The types of tests conducted in the development of the system are unit testing, integration testing and also user acceptance testing.

Unit Testing

A unit test is a procedure used to validate that a particular module of source code is working properly. The procedure is to write test cases for all functions and methods so that whenever a change causes a regression, it can be quickly identified and fixed. The goal of unit testing is to isolate each part of the program and show that the individual parts are correct. This type of testing is mostly done by the developers and not by end-users. In this case, each of the buttons in the system is tested individually to make certain that the system runs smoothly and in accord.

Integration Testing

Integration testing takes as its input modules that have been checked out by unit testing, groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and delivers as its output the integrated system ready for system testing. The purpose of integration testing is to verify functional, performance and reliability requirements placed on major design items. For this project, the system as a whole is tested once all of the units are tested and succeeded.

User Acceptance Testing

User acceptance testing, also known as usability testing is a means for measuring how well people can use some human-made object for its intended purpose. Setting up a usability test involves carefully creating a scenario, or realistic situation, wherein the person performs a list of tasks using the product being tested while observers watch and take notes. Refer to **Appendix 2-1** for a sample of the User Acceptance Testing.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

As a conclusion, the system is able to guide and illustrate the most suitable programming languages (Java and C++) for the programmers or software developers using the system. By answering the questions prepared and designed in the system, programmers or software developers are able to measure and gauge the level of strength, skills and knowledge of the respective programming languages. Questions in terms of the level of experience, the security of both the programming languages as a network of programming language, the features of both the programming languages (variables, constants, data types, arrays, if-else decisions, loops, iterations, sequences, inheritance, polymorphism, methods, procedures and also the error controls) are all provided in the questions of the system. By the result of this extent, programmers or software developers are able to develop programs, systems or even software that suits them best and in this case, Java or C++ programming languages.

5.2 Recommendations

This system is recommended to be developed as a Web-based system which will enable any user from across the globe gain access on the system provided that they are connected to the Internet. Other recommendations include developing other decision support systems that can also decide what other programming languages are suitable for the programmers.

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APPENDICES

Appendix 1-1: Questions

Below are the questions to be answered in the system:

1. **How many years have you been actively programming?**
   a. Less Than 1 Year
   b. 1 -2 Years
   c. 3 -5 Years
   d. 5 – 10 Years
   e. More Than 10 Years

2. **Using the levels of experience below, how experienced would you rate yourself?**
   a. Novice Programmer
   b. Intermediate Programmer
   c. Expert Programmer

3. **What is your purpose in using Java / C++?**
   a. Just a Hobby
   b. I am a Classroom-Only Programmer
   c. I Have Been Using for Research and Development

4. **Which of the frameworks usually takes you less time to develop an application?**
   a. Java
   b. C++

5. **Which framework from your point of view has better development environments?**

a. Java

b. C++

6. **Java Programming Languages:**

6i. What is the estimated language complexity level?

a. Low

b. Medium

c. High

6ii. How frequent are the application(s) written in the Java programming language?

a. Rarely

b. Sometimes

c. Occasionally

d. Always

6iii. In general, do you think Java is feature-rich enough?

a. Yes

b. No

c. Not Sure

6iv. What is your opinion of the security of Java as a network programming language?

a. Very Secure

b. Somewhat Secure

c. Somewhat Insecure

d. Very Insecure

6v. Choose the phrase that best describes your understanding of the programming language topics below.

- *Variables, Constants and Data Types*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Logic Structures: Sequence*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Logic Structures: Decision (If)*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Logic Structures: Iteration (Loop)*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Methods or Procedures*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Arrays*
  a. Not At All
  b. Weak
  c. Moderate

d. Strong

- *Encapsulation, Inheritance and Polymorphism*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong

6vi. What is your general impression of the quality of error messages in this language?

a. Poor
b. Average
c. Good
d. Excellent

6vii. Using the kinds of problems below, how do you see the error messages in this language being deficient?

a. Obscure / Vague in Content
b. Misleading in Information
c. Unfriendly in Tone
d. Unhelpful in Removing Error

7. C++ Programming Languages:

7i. What is the estimated language complexity level?

a. Low

b. Medium

c. High

7ii. How frequent are the application(s) written in the C++ programming language?

a. Rarely

b. Sometimes

c. Occasionally

d. Always

7iii. In general, do you think C++ is feature-rich enough?

a. Yes

b. No

c. Not Sure

7iv. What is your opinion of the security of C++ as a network programming language?

a. Very Secure

b. Somewhat Secure

c. Somewhat Insecure

d. Very Insecure

7v. Choose the phrase that best describes your understanding of the programming language topics below.

- *Variables, Constants and Data Types*

  a. Not At All

  b. Weak

  c. Moderate

d. Strong

- *Logic Structures: Sequence*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Logic Structures: Decision (If)*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Logic Structures: Iteration (Loop)*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Methods or Procedures*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Arrays*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong
- *Encapsulation, Inheritance and Polymorphism*
  a. Not At All
  b. Weak
  c. Moderate
  d. Strong

7vi. What is your general impression of the quality of error messages in this language?

a. Poor

b. Average

c. Good

d. Excellent

7vii. Using the kinds of problems below, how do you see the error messages in this language being deficient?

a. Obscure / Vague in Content

b. Misleading in Information

c. Unfriendly in Tone

d. Unhelpful in Removing Error

Tester Name: _____

Signature: _____

Date: _____

User Acceptance Test

Scenario:

A. Check functionality of the system (buttons)

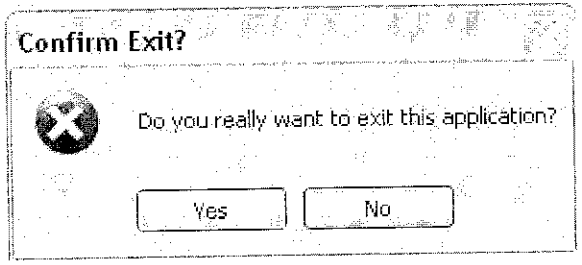
Overview:

- Description of the parameters in the screen:

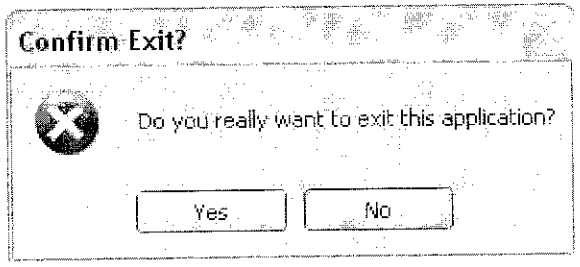
Item	Description
Reset	This button is used when the user wishes to reset the radio buttons
Back	This button is used when the user wishes to view the previous page or form
Next	This button is used when the user wishes to view the next page or

Item	Description
	form
Submit	This button is used when the user has finished answering the questions and wishes to view the results
Exit	This button is used when the user wishes to quit from the system while answering the questions
Take this Test Again!	This button is used when the user wishes to take the test again after viewing the result
I am Done!	This field is used when the user wishes to quit from the system once the result has been viewed

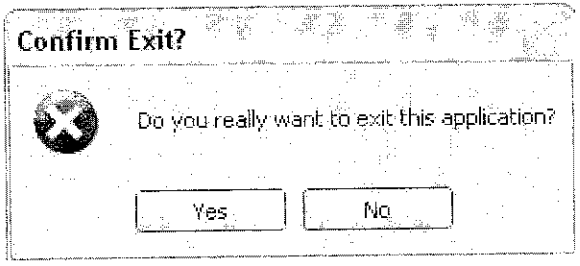
A. Check Functionality of the Buttons in the System (First Page)

Step	Scenario	Expected Result	Actual Result	Remarks
1.	Click on the 'Reset' button	All of the radio buttons will be reset and the answers will be cleared		
2.	Click on the 'Next' button	The system will view the next page		
3.	Click on the 'Exit' button	A pop-up window will appear indicating the user to confirm the exit 		

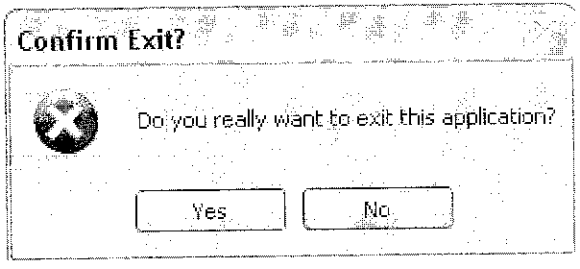
B. Check Functionality of the Buttons in the System (Second Page)

Step	Scenario	Expected Result	Actual Result	Remarks
1.	Click on the 'Reset' button	All of the radio buttons will be reset and the answers will be cleared		
2.	Click on the 'Back" button	The system will view the previous page		
3.	Click on the 'Next' button	The system will view the next page		
4.	Click on the 'Exit' button	A pop-up window will appear indicating the user to confirm the exit 		

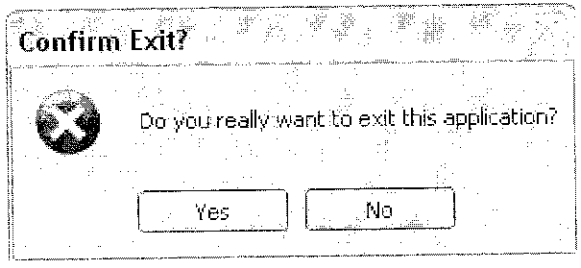
C. Check Functionality of the Buttons in the System (Third Page)

Step	Scenario	Expected Result	Actual Result	Remarks
1.	Click on the 'Reset' button	All of the radio buttons will be reset and the answers will be cleared		
2.	Click on the 'Back" button	The system will view the previous page		
3.	Click on the 'Next' button	The system will view the next page		
4.	Click on the 'Exit' button	A pop-up window will appear indicating the user to confirm the exit 		

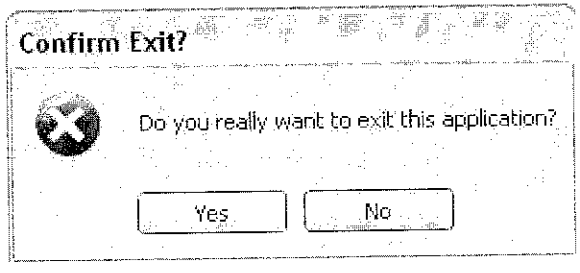
D. Check Functionality of the Buttons in the System (Fourth Page)

Step	Scenario	Expected Result	Actual Result	Remarks
1.	Click on the 'Reset' button	All of the radio buttons will be reset and the answers will be cleared		
2.	Click on the 'Back" button	The system will view the previous page		
3.	Click on the 'Next' button	The system will view the next page		
4.	Click on the 'Exit' button	A pop-up window will appear indicating the user to confirm the exit 		

E. Check Functionality of the Buttons in the System (Fifth Page)

Step	Scenario	Expected Result	Actual Result	Remarks
1.	Click on the 'Reset' button	All of the radio buttons will be reset and the answers will be cleared		
2.	Click on the 'Back" button	The system will view the previous page		
3.	Click on the 'Next' button	The system will view the next page		
4.	Click on the 'Exit' button	A pop-up window will appear indicating the user to confirm the exit 		

F. Check Functionality of the Buttons in the System (Sixth Page)

Step	Scenario	Expected Result	Actual Result	Remarks
1.	Click on the 'Reset' button	All of the radio buttons will be reset and the answers will be cleared		
2.	Click on the 'Back" button	The system will view the previous page		
3.	Click on the 'Submit' button	The system will generate the answers and will view the result based on the answers		
4.	Click on the 'Exit' button	A pop-up window will appear indicating the user to confirm the exit 		

G. Check Functionality of the Buttons in the System – If the result views Java programming language (Seventh Page)

Step	Scenario	Expected Result	Actual Result	Remarks
1.	Click on the 'Take this Test Again!' button	The system will view the first page for user to take the test again		
2.	Click on the 'I am Done!" button	A pop-up window will appear indicating the user to confirm the exit