e-Quals Unit Syllabus

Level 3 Develop software using C++

7266/7267-302

www.cityandguilds.com/e-quals07
August 2008
Version 2.0

About City & Guilds

City & Guilds is the UK's leading provider of vocational qualifications, offering over 500 awards across a wide range of industries, and progressing from entry level to the highest levels of professional achievement. With over 8500 centres in 100 countries, City & Guilds is recognised by employers worldwide for providing qualifications that offer proof of the skills they need to get the job done.

City & Guilds Group

The City & Guilds Group includes City & Guilds, ILM (the Institute of Leadership & Management) which provides management qualifications, learning materials and membership services, NPTC which offers land-based qualifications and membership services, and HAB (the Hospitality Awarding Body). City & Guilds also manages the Engineering Council Examinations on behalf of the Engineering Council.

Equal opportunities

City & Guilds fully supports the principle of equal opportunities and we are committed to satisfying this principle in all our activities and published material. A copy of our equal opportunities policy statement *Access to assessment and qualifications* is available on the City & Guilds website.

Copyright

The content of this document is, unless otherwise indicated, © The City and Guilds of London Institute 2007 and may not be copied, reproduced or distributed without prior written consent.

However, approved City & Guilds centres and learners studying for City & Guilds qualifications may photocopy this document free of charge and/or include a locked PDF version of it on centre intranets on the following conditions:

- centre staff may copy the material only for the purpose of teaching learners working towards a City & Guilds qualification, or for internal administration purposes
- learners may copy the material only for their own use when working towards a City & Guilds qualification
- the *Standard Copying Conditions* on the City & Guilds website.

Please note: National Occupational Standards are not © The City and Guilds of London Institute. Please check the conditions upon which they may be copied with the relevant Sector Skills Council.

Publications

City & Guilds publications are available on the City & Guilds website or from our Publications Sales department at the address below or by telephoning +44 (0)20 7294 2850 or faxing +44 (0)20 7294 3387.

Every effort has been made to ensure that the information contained in this publication is true and correct at the time of going to press. However, City & Guilds' products and services are subject to continuous development and improvement and the right is reserved to change products and services from time to time. City & Guilds cannot accept liability for loss or damage arising from the use of information in this publication.

City & Guilds
1 Giltspur Street
London EC1A 9DD
T +44 (0)20 7294 2787
F +44 (0)20 7294 2413
www.cityandguilds.com
centresupport@cityandguilds.com

Contents

Unit 302	**Develop software using C++**	
Outcome 1	Interpret program specifications to develop software	3
Outcome 2	Develop software components	4
Outcome 3	Use functions	6
Outcome 4	Save and retrieve data from a file	7
Outcome 5	Use Object Orientated Programming (OOP)	8
Outcome 6	Test software using change control	9
Outcome 7	Produce documentation	10
Unit record sheet		11

Unit 302 Develop software using C++

Rationale

The aim of this unit is to enable candidates to understand the principles required to develop software using the C++ programming language. Candidates will develop the skills required to design, create and test software to solve a given problem.

Learning outcomes

There are **seven** outcomes to this unit. The candidate will be able to:

Interpret program specifications to develop software
Develop software components
Use functions
Save and retrieve data from a file
Use Object Orientated Programming (OOP)
Test software using change control
Produce documentation

Guided learning hours

It is recommended that 90 hours should be allocated for this unit. This may be on a full time or part time basis.

Connections with other qualifications

This unit contributes towards the knowledge and understanding required for the following qualifications:

Outcome	This award contributes to the knowledge and understanding of the following Areas of Occupational Competence in the City & Guilds NVQ for IT Professionals (4324)
1,2,3,4,5,6, 7	311 Software development – component creation 3

Key Skills

This unit contributes towards the Key Skills in the following areas:

Communication	C1.3, C3.2
Application of Number	N1.1
Information technology	None
Working with others	None
Improving own learning	LP3.1, LP3.2, LP3.3
Problem solving	PS3.1, PS3.2, PS3.3

Assessment and grading

Assessment will be by means of a **set assignment covering** practical activities, and a **multiple choice test** covering underpinning knowledge.

Unit 302 Develop software using C++

Outcome 1 Interpret program specifications to develop software

Practical skills

The candidate will be able to:

1 specify the components required to create software from a project specification

2 create software from the design

3 use suitable validation on user input

4 provide a solution which is easily maintained and fulfils the specification.

Underpinning knowledge

The candidate will be able to:

1 identify the need for program design

2 describe the need for validation

3 identify that control structures take on a similar role between languages ie:

   a selection

   b sequence

   c iteration.

Unit 302 Develop software using C++
Outcome 2 Develop software components

Practical skills

The candidate will be able to:

1 develop programs using the data types **int**, **float**, **double** and **char**

2 use the data qualifiers **long**, **short**, **signed** and **unsigned**

3 declare and use **struct**

4 declare and initialise a pointer

5 use pointers to access and alter values stored

6 use **switch** statements

7 design algorithms to validate user input

8 construct and use one and two dimensional arrays of data types:

int[] char[] float[]

9 develop header files to define shared constants and functions

10 use header files to define constants, external functions and simple macros

11 use the assignment operators:

= + = - = * = / = % =

12 use casting in a program

13 use the ++ and – operators in prefix and postfix mode

14 use enumeration to specify a set of constants

15 use local and global variables as appropriate.

Underpinning knowledge

The candidate will be able to:

1 describe the format of a **struct**

2 identify an array of structures

3 explain that a pointer is a variable that holds the memory address of another variable

4 explain that the name of an array is equivalent to a pointer to the first element of that array

5 identify the use of a **switch** statement in selection

6 describe the purpose of **default**, **break** and **continue** in a **switch** statement

7 explain the difference between a one and two-dimensional array

8 describe the component parts of a string

9 identify the declaration of user defined header files

10 describe the use of the assignment operators =, + =, - =, * =, / = and % =

11 explain the reason for casting in a program

12 describe enumeration

13 explain the use of the ++ and -- operators in prefix and postfix mode

14 explain the use of:

a **static**

b **auto**

c **const**

15 identify the difference between local and global variables

16 describe the use of the NULL pointer

17 identify the declaration of one and two dimensional arrays.

Unit 302 Develop software using C++
Outcome 3 Use functions

Practical skills

The candidate will be able to:

1 create a program using functions and pass parameters by value (copy)

2 create a program using functions and pass parameters by reference

3 pass a structure to a function

4 pass a string to a function

5 create functions that return values to the calling function of data types **char**, **int** and **float**

6 use pre-defined functions

7 use **#define** or **const** in a program

8 use a clear screen function.

Underpinning knowledge

The candidate will be able to:

1 describe the meaning of passing parameters by value (copy) to functions

2 describe the meaning of passing parameters by reference to functions

3 identify the return type of a function

4 explain the need for function prototypes

5 explain why default parameters are used

6 describe how functions can be overloaded

7 describe the use of **const** with a function argument

8 explain the scope of **const**

9 explain the difference between **#include** and **#define** directives

10 identify and describe the pre-defined functions:

- a **strcpy()**
- b **strcat ()**
- c **strlen()**
- d **atoi()**
- e **atof()**
- f **gets()**
- g **puts()**
- h **toupper()**
- i **tolower()**

Unit 302 Develop software using C++

Outcome 4 Save and retrieve data from a file

Practical skills

The candidate will be able to:

1 use standard header files to define functions and data types for input/output routines

2 manipulate files:

- a write to a file
- b read from a file
- c append to a file

3 create files of type:

- a text
- b binary

4 declare file objects

5 use **cerr** in a program.

Underpinning knowledge

The candidate will be able to:

1 explain the need for a file object

2 explain the purpose of input and output modes

3 explain the importance of closing a file after use

4 explain the correct method to close a file on disk

5 identify the purpose of the file streams **fstream**, **istream** and **ostream**

6 identify the hierarchy of the file handling streams

7 explain the purpose of **cerr**.

Unit 302 Develop software using C++

Outcome 5 Use Object Orientated Programming (OOP)

Practical skills

The candidate will be able to:

1 use classes in program design incorporating:
   - a objects
   - b methods
   - c attributes

2 use the scope resolution operator **::**

3 use an inline functions

4 create classes using inheritance

5 use the following in a program:
   - a constructor
   - b destructor

6 use the **this** pointer in a program.

Underpinning knowledge

The candidate will be able to:

1 identify a program that uses classes

2 explain an instance of a class

3 describe what is meant by the keywords **private** and **public**

4 describe the difference between attributes and methods

5 explain the meaning of:
   - a encapsulation
   - b inheritance
   - c polymorphism

6 describe the purpose of:
   - a an inline function
   - b a friend function

7 explain what is meant by reusability

8 explain the purpose of a constructor and a destructor in a program

9 explain the purpose of the tilde (~)

10 describe the purpose of the scope resolution operator **::**

11 explain the function of the **this** pointer

12 explain that an object of a class can be initialised when instantiated

13 describe the main components of an object.

Unit 302 Develop software using C++
Outcome 6 Test software using change control

Practical skills

The candidate will be able to:

1 verify that the program conforms to the design specification

2 implement change control procedures

3 test the software according to a prepared test plan

4 determine the expected results from a given set of test data

5 compare the expected results to the actual results and correct any errors

6 keep a log of the results for each test clearly identifying:

   a any discrepancies between the expected and actual results

   b amendments made to correct errors

7 resolve logical and run-time errors found during testing.

Underpinning knowledge

The candidate will be able to:

1 explain the reasons for testing a program prior to implementation

2 describe the meaning of a dry run

3 describe the meaning of a compilation error

4 describe the meaning of a run-time error

5 describe the purpose of test data

6 explain the need to test software in the target environment

7 state the difference between interfacing and integration

8 explain the need for overall control when developing software projects

9 identify the benefits of teamwork to avoid duplication of effort, when working on a large project

10 describe the need for control and documentation of any changes to programs.

Unit 302 Develop software using C++

Outcome 7 Produce documentation

Practical skills

The candidate will be able to:

1 produce end user instructions that are clear and unambiguous

2 produce technical documentation (including any class interface) to describe the purpose of the program and its operation

3 print a listing of code.

Underpinning knowledge

The candidate will be able to:

1 identify the need for end user instructions

2 describe the need for technical documentation to aid future maintenance and reusability.

Unit record sheet

Use this form to track your progress through this unit.

Tick the boxes when you have covered each outcome. When they are all ticked, you are ready to be assessed.

Outcome	✓	Date
1 **Interpret program specifications to develop software**	☐	
2 **Develop software components**	☐	
3 **Use functions**	☐	
4 **Save and retrieve data from a file**	☐	
5 **Use Object Orientated Programming (OOP)**	☐	
6 **Test software using change control**	☐	
7 **Produce documentation**	☐	

Candidate Signature ..... **Date** .....

City & Guilds Registration Number ....

Centre Name ..... **Centre Number** .....

Published by City & Guilds
1 Giltspur Street
London
EC1A 9DD
T +44 (0)20 7294 2468
F +44 (0)20 7294 2400
www.cityandguilds.com
www.cityandguilds.com/e-quals07

City & Guilds is a registered charity established to promote education and training