-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

HIGHER NATIONAL UNIT SPECIFICATION

GENERAL INFORMATION

-Unit Number- **7481724**

-Superclass- **RB**

-Title- **INTRODUCTORY MATHEMATICS FOR COMPUTING**

-DESCRIPTION-

GENERAL COMPETENCE FOR UNIT: Using mathematical techniques which are especially important in computing.

OUTCOMES

1. interpret and use positive and negative integers in different number bases;
2. use floating point arithmetic in base 10;
3. perform operations on sets;
4. apply the laws of Boolean algebra.

CREDIT VALUE: 1 HN Credit

ACCESS STATEMENT: Access to this unit is at the discretion of the centre. However, it would be beneficial if the candidate had skills in basic numeracy or an equivalent level of experience.

For further information contact: Committee and Despatch Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ.

Additional copies of this unit may be purchased from SQA (Sales and Despatch section). At the time of publication, the cost is £1.50 (minimum order £5).

HIGHER NATIONAL UNIT SPECIFICATION

STATEMENT OF STANDARDS

UNIT NUMBER: 7481724

UNIT TITLE: INTRODUCTORY MATHEMATICS FOR COMPUTING

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME

1 INTERPRET AND USE POSITIVE AND NEGATIVE INTEGERS IN DIFFERENT NUMBER BASES

PERFORMANCE CRITERIA

(a) The statement of the place value of a digit of a number in a given base is correct.
(b) The manual conversion of a number from a given base to a specific base or vice versa is correct.
(c) The performance of simple arithmetic in a given base is correct.

RANGE STATEMENT

The range for this outcome is fully expressed within the performance criteria.

EVIDENCE REQUIREMENTS

Minimum of 2 interpretations involving bases chosen from binary, octal, denary and hexadecimal PCs (a) and (b).

Minimum of 2 calculations chosen from addition, subtraction, multiplication and division PC(c).

OUTCOME

2 USE FLOATING POINT ARITHMETIC IN BASE 10

PERFORMANCE CRITERIA

(a) The expression of a number in scientific notation is accurate.
(b) The rounding of a number to a specified number of significant figures is correct.
(c) The performance of simple arithmetic, using appropriate techniques is correct.
(d) The calculation of absolute and relative errors, for a number expressed in scientific notation is correct.

RANGE STATEMENT

The range for this outcome is fully expressed within the performance criteria.

EVIDENCE REQUIREMENTS

Minimum of 2 correct responses for each performance criterion.

OUTCOME

3 PERFORM OPERATIONS ON SETS

PERFORMANCE CRITERIA

(a) The listing of a set specified in set-builder notation is correct.
(b) The listing of the union, intersection and complement of given sets is correct.
(c) The shading of the area corresponding to a given set in a constructed Venn diagram is correct.
(d) The generation of the elements of the power set of a given finite set is correct.
(e) The generation of the elements of the Cartesian product of given sets is correct.

RANGE STATEMENT

The range for this outcome is fully expressed within the performance criteria.

EVIDENCE REQUIREMENTS

Written list PC(a).

Written list for each of union, intersection and complement PC(b).

Venn diagram using three subsets of a specified universal set PC(c).

Written list for a three element set PC(d).

Written list for a maximum of three sets containing a maximum of three elements PC(e).

OUTCOME

4 APPLY THE LAWS OF BOOLEAN ALGEBRA

PERFORMANCE CRITERIA

(a) The construction of a table of closure properties is correct.
(b) The calculation of a Boolean expression which fits given requirements is correct.
(c) The simplification of a Boolean expression using an acceptable technique is correct.

RANGE STATEMENT

Table of closure, constructed with 3 variables.

Expression(s): consisting of 3 variables.

EVIDENCE REQUIREMENTS

Table PC(a).
Calculations PC(b), (c).

MERIT

A candidate who achieves all performance criteria for all outcomes will be awarded a pass. A pass with merit may be awarded to a candidate who demonstrates superior performance throughout the unit in each of the following aspects:

- consistently high level of accuracy
- outstanding skills of analysis
- consistently logical presentation of work.

Evidence which satisfies the criteria for merit may be generated by either:

- solving the problem to a level beyond that defined as pass
  or
- where this is not possible, including in the assessment a further section which would allow the candidate to demonstrate skills which satisfy the criteria for merit.

ASSESSMENT

In order to achieve this unit, candidates are required to present sufficient evidence that they have met all the performance criteria for each outcome within the range specified. Details of these requirements are given for each outcome. The assessment instruments used should follow the general guidance offered by the SQA assessment model and an integrative approach to assessment is encouraged. (See references at the end of the support notes).

Accurate records should be made of the assessment instruments used showing how evidence is generated for each outcome and giving marking schemes and/or checklists, etc. Records of candidates' achievements should also be kept. These records will be required for external verification.

SPECIAL NEEDS

Proposals to modify outcomes, range statements or agreed assessment arrangements should be discussed in the first place with the external verifier.

HIGHER NATIONAL UNIT SPECIFICATION

SUPPORT NOTES

UNIT NUMBER: 7481724

UNIT TITLE: INTRODUCTORY MATHEMATICS FOR COMPUTING

SUPPORT NOTES: This part of the unit specification is offered as guidance. None of the sections of the support notes is mandatory.

NOTIONAL DESIGN LENGTH: SQA allocates a notional design length to a unit on the basis of the time estimated for achievement of the stated standards by a candidate whose starting point is as described in the access statement. The notional design length for this unit is 40 hours. The use of notional design length for programme design and timetabling is advisory only.

CONTENT/CONTEXT Corresponding to outcomes:

1. Positive and negative integers to be converted between bases 2, 8, 10 and 16. Numbers in base 2, 8 or 16 to be added, subtracted, multiplied and divided.

2. Real numbers rounded and converted to scientific notation and vice-versa. Calculations of addition, subtraction, multiplication and division performed in real number and scientific notation. Absolute and relative errors determined for the aforementioned calculations. Computer representation of real numbers and loss of significance in real number arithmetic.

3. Concepts of a set, element, membership, universal set, empty set and ways of specifying a set. Equality of sets. Set builder notation. Concepts, definitions and notation(s) for union, intersection and complement. Construction and shading of Venn diagrams to illustrate expressions based on union intersection and complement of sets eg: (AUB)'n C.

   Concept, definition and notation for subsets.

   The power set of a finite set is defined as the set of all subsets of the given set and examples involving sets with up to four elements are given. The Cartesian product is defined and appropriate examples are given.

4. This outcome may include examples of the Boolean algebra of sets, logic and switching circuits.

   Concepts of Boolean variable with two possible states 1 and 0 (representing TRUE/FALSE, On/Off, High/Low voltage, Closed/Open switch, Universal/Empty set). Concepts, definitions and notations for AND, OR, NOT operators. Symbols for AND, OR, NOT gates.

   Truth table (table of closure properties) is used to represent Boolean expressions, to prove equality of expressions and to prove laws of Boolean algebra.

   Boolean expression is derived to match a truth table, logic diagram or switching circuit. Simplification of expressions may be carried out using the laws of Boolean algebra or Karnaugh maps.

   AND, OR, NOT operators may be related to compound conditions in computer programs.

   Throughout, use of computer software and calculators may be employed to reinforce the concepts and to reduce manual calculations.

APPROACHES TO GENERATING EVIDENCE It is recommended that the consolidation of skills be achieved by including problem solving in a practical and vocational content and not only by mechanical exercises.

ASSESSMENT PROCEDURES Centres may use the instruments of assessment which are considered by tutors/trainers to be most appropriate. Examples of instruments of assessment which could be used are as follows:

Corresponding to outcomes:

1. Calculation Exercise

   The topics may be assessed on the number of occasions indicated.

   (a) State place value 3
   (b) Convert 3
   (c) Calculate 3

   The candidate would be required to produce at least 2 correct responses for each of (a), (b) and (c).

2. Calculation Exercise

` The topics may be assessed on the number of occasions indicated.

(a)	Express in scientific notation	3
(b)	Round to specified number of significant figures	3
(c)	Perform arithmetic calculations	3
(d)	Obtain errors	3

The candidate would be required to produce at least 2 correct responses for each of (a), (b), (c) and (d).

3. Short answer questions. The topics may be assessed on the number of occasions indicated.

(a)	Set is listed		1
(b)	Union is listed	1	
	Intersection is listed	1	
	Complement is listed	1	

Graphical Exercise

(c)	Venn diagram is constructed and shaded	1

Short Answer Questions. The topics may be assessed on the number of occasions indicated.

(d)	Elements of power set are listed	1
(e)	Elements of Cartesian products are listed	1

4. Calculation Exercise. The topics may be assessed on the number of occasions indicated.

(a)	Table of closure properties is constructed		1
(b)	Boolean expression is obtained to match:		
	(i)	truth table	1
	(ii)	logic diagram	1
	(iii)	switching circuit	1
(c)	Boolean expression is simplified		3

If the candidate can produce a correct response for (a) and at least two correct responses for each of (b) and (c), this would provide sufficient evidence for achieving the performance criteria.

PROGRESSION For information on how this unit relates to National Certificate Mathematics provision and to other units in the Higher National Mathematics framework, please refer to the following grid:

- Higher National Mathematics grid for computing

REFERENCES

1. Guide to unit writing.
2. SQA's National Standards for Assesors and Verifiers.
3. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment.

HIGHER NATIONAL MATHEMATICS GRID FOR COMPUTING