-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

HIGHER NATIONAL UNIT SPECIFICATION

GENERAL INFORMATION

-Unit Number- **7481734**
-Superclass- **RB**

-Title- **MATHEMATICS FOR COMPUTING**

-DESCRIPTION-

GENERAL COMPETENCE FOR UNIT: Working with matrices, relations and graphs types.

OUTCOMES

1. perform the operations of matrix algebra;

2. display relations and functions;

3. generate and interpret recursively defined functions;

4. apply properties and techniques of graph theory to construct and analyse planar graphs.

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 mathematics as evidenced by possession of National Certificate Module 7180331 Core Mathematics 4; Standard Grade Mathematics at 3 and above; or an equivalent level of experience.

For further information contact: Committee and Administration 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: 7481734

UNIT TITLE: 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 PERFORM THE OPERATIONS OF MATRIX ALGEBRA

PERFORMANCE CRITERIA

(a) The performance of simple arithmetic on matrices is correct.
(b) Calculations of a 3 x 3 matrix inverse, using row operations is correct.
(c) Solution of a system of linear equations in 3 unknowns, using matrix methods, is correct.
(d) Manipulation of 2-dimensional position vectors, using appropriate transformation matrices, is correct.

RANGE STATEMENT

Matrix methods: elimination; use of inverse matrix.

EVIDENCE REQUIREMENTS

Minimum of 2 correct calculations. The calculations must cover 2 of the following:

addition
subtraction
multiplication
transposition PC(a)

One correct calculation. PC(b)

One correct calculation for each category of the range. PC(c)

One correct calculation. PC(d)

OUTCOME

2 DISPLAY RELATIONS AND FUNCTIONS

PERFORMANCE CRITERIA

(a) The transformation of a relation, given in one form, to a specified alternative form, is correct.
(b) Identification of relations which are functions is correct.
(c) The identification of injection, surjection and bijection is correct.
(d) The generation of the inverse for a bijective function is correct.

RANGE STATEMENT

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

EVIDENCE REQUIREMENTS

Minimum of 2 conversions with forms chosen from the following:

arrow diagrams
formula
Cartesian graph
set of ordered pairs PC(a)

Correct response for each of a minimum of 4 given relations. PC(b)

Correct response for each of a minimum of 4 given arrow diagrams. PC(c)

At least one correct response. PC(d)

OUTCOME

3 GENERATE AND INTERPRET RECURSIVELY DEFINED FUNCTIONS

PERFORMANCE CRITERIA

(a) The identification of the recursive step and stopping condition of a recursive function is correct.
(b) The generation of a recursively defined function is correct.

RANGE STATEMENT

Recursive function: numeric; character.

EVIDENCE REQUIREMENTS

One correct response for each category of range for each of PCs (a) and (b).

OUTCOME

4 APPLY PROPERTIES AND TECHNIQUES OF GRAPH THEORY TO CONSTRUCT AND ANALYSE PLANAR GRAPHS

PERFORMANCE CRITERIA

(a) The statement of the number of vertices and edges of a graph specified by an incidence matrix is correct.
(b) The generation of an appropriate circuit for a given graph is correct.
(c) Identification of isomorphic graphs, using incidence matrices, is correct.
(d) Application of weights to a graph is correct.
(e) Calculation of the length of a specified path in a weighted graph is correct.

RANGE STATEMENT

Circuit: Hamiltonian; Eulerian.

EVIDENCE REQUIREMENTS

At least one correct response of PCs (a), (c), (d) and (e). One correct response for each category of range. PC(b).

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: 7481734

UNIT TITLE: 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.

PURPOSE This unit enables the candidate to work with matrices, relations and graph types in the context of computing.

CONTENT/CONTEXT Corresponding to outcomes:

1. Sum, difference, product (when it exists), transpose and multiplication by a scalar of matrices up to order (3 x 3). Verification of inverse by multiplication. Inverse of (3 x 3) by row/column transformations. Solution of $\mathbf{A}\underline{\mathbf{x}} = \underline{\mathbf{h}}$ using augmented matrix and row/column manipulations, and use of $\underline{\mathbf{x}} = \mathbf{A}^{-1}\underline{\mathbf{h}}$ for solving more than one system of equations which differ only in $\underline{\mathbf{h}}$.

   Position vectors for points on (x, y) plane; transformation matrices for contraction, dilation, reflection, rotation and displacement of points (vectors). Association with elementary computer graphics.

2. Relations depicted as arrow diagrams, sets of ordered pairs, points on a Cartesian graph, or a formula. Appropriate relations are identified as being injective, surjective, bijective, and functions. Inverse functions are derived as arrow diagrams, sets of ordered pairs, points on a graph, or a simple formula in no more than 3 variables.

3. The candidate should be able to generate examples drawn from arithmetic (Fibonacci, geometric, arithmetic sequences etc), and from strings generated recursively for different alphabets (including `lengths').

See, for example, chapters 4.3 and 4.4 of "Discrete Mathematics", 3rd edition, K.A. Ross and C.R.B. Wright, Prentice-Hall (1992).

4. The candidate should be able to:

   (i) construct the relevant incidence matrix for relatively planar graphs and vice-versa;
   (ii) identify tours and circuits in given graphs and deduce shortest paths, by inspection, for simple network problems (Chapter 6, "Decision Mathematics", The Spode Group, Ellis Horwood, 1986).

APPROACHES TO GENERATING EVIDENCE Corresponding to outcomes:

The candidate should be shown illustrative examples, followed by candidate-centred tutorial work.

ASSESSMENT PROCEDURES Corresponding to outcomes:

Satisfactory completion of evidence requirements for an example not previously seen by the candidate and under the supervision of the assessor.

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. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment.
3. Information for centres on SQA's operating procedures is contained in SQA's Guide to Procedures.
4. For details of other SQA publications, please consult SQA's publication list.

HIGHER NATIONAL MATHEMATICS GRID FOR COMPUTING