In this section, we will examine in detail, the rubrics and requirements for School-assessed Task SAT assessments for Unit 3 VCE Algorithmics in 2021.

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In this session we will examine in detail the rubrics and requirements for the School-assessed Task, SAT task for Unit 3. Criteria 1–6 for 2021, and look at the authentication and the assessment requirements. This is the SAT overview for Unit 3 2021.

The Unit 3 School-assessed Task consists of three components across three outcomes. These components are: folios, written explanations and a project. These components are assessed against six rubric criteria which are; understanding of abstract data types, skill in the application of abstract data types, understanding of the principles of algorithm design, skills in the application of the principles of algorithm design, skills in the evaluation of algorithms and data representation, and skills in documentation and communication of solutions to information problems.

This table summarises the outcome components against the rubric criteria for Unit 3 SAT Task. For Outcome 1, this pertains to the study of abstract data types and is assessed against Criteria 1 by a timed written explanation and Criteria 2 by folio and project tasks. Outcome 2 pertains to the study of algorithm design and is assessed against Criteria 3 by a timed written explanation and Criteria 4 by folio and project tasks. Outcome 3 pertains to the study of applications and is assessed against Criteria 5 and 6 by written reports.

The folios for this SAT cover Criterion 2 and 4 and they shall consist of between 2 to 4 small tasks, using a range of abstract data types to model the salient aspects of problems assessed against Criteria 2, which is the application of ADTs. Between 2 to 4 small tasks against a range of algorithm design patterns to specify algorithms to solve problems assessed against Criteria 4, application of algorithm design patterns. And it is recommended that teachers give students the chance to complete up to 4 tasks in each criterion category. Tasks may increase in complexity and difficulty through the semester to reflect the progression of student learning.

The SAT written explanation, Criteria 1 and 3, covers two outcomes. Outcome 1, the specification and application of ADTs, that's Criterion 1. Outcome 2, the specification and application of algorithms against Criteria 3. Each task is to be completed under test conditions within a 45 to 60 minute timeframe. Each task must allow for students to demonstrate the full range of performance. A mixture of question types is appropriate.

The project is assessed through Criteria 2, 4, 5 and 6. And it consists of a data model of a real world problem, including specification of the data model, a concrete instance of the data model, as a worked example, and documentation of the data model development approach, in approximately 300 to 500 words. Also an algorithm to solve a real-world problem that builds on existing data model which is including pseudocode to solve the problem, implementation of the algorithm in a high-level programming language making appropriate use of the standard abstract data types and documentation of the algorithm development approach, approximately 300 to 500 words. And also an evaluation of an existing data model and algorithm in the form of a written report, approximately 300 to 500 words. For the project, again, to reiterate, the data model is assessed through Criterion 2. The algorithm for the project is assessed through Criterion 4. The evaluation is assessed through Criterion 5 and documentation of all stages is assessed through Criterion 6.

Project tasks should be designed with the SAT criteria and authentication requirements in mind. Where the quality of the student's data model would not allow for the student to sufficiently complete the algorithm then the teacher may modify the student's work or provide the student with a new data model. Students will have engaged with the Unit 3 project at multiple levels. Teacher judgment can be used if required to further assist student understanding across the whole cohort by providing them with the same algorithmic model and pseudocode solution to a problem and assess their evaluation and communication skills further if necessary.

Unpacking the Criteria for Unit 3. In the next section we will look at how each of the Unit 3 outcomes, key knowledge and key skills lead to the criteria of assessment. Written explanations are timed and supervised tests. These are assessed in Criterion 1, abstract data types, and Criterion 3, algorithms. Teachers need to ensure a good spread of difficulty in the questions set for these timed tests.

Teachers must design questions based on performance described in each of the criteria. Criterion 1 Test Key knowledge includes: the motivation for using ADTs, modularisation and abstraction of information representation with ADTs Key skills include: explain the role of ADTs for data modeling. Teachers must reference the criteria descriptors to set the questions to assess the level of knowledge and skill from very low to very high. For example, students scores 1–2 is very low. The descriptor is: Describes motivation for the abstraction of data. Students scores 3–4 is low. The descriptor is: Explains the general concept of an ADT using more than one example. Student scores 5–6 is medium. The descriptor is: Describes the function of ADTs using appropriate metalanguage. Also, provides the appropriate examples of applications for the ADTs. Criterion 1 Test Key knowledge: signature specifications of ADTs using operator names, argument types and result types. Key skills: read and write ADT signature specifications. For example, teachers must, for a student's score of 7–8, which is high, the descriptor is: Writes complete signature specifications for several ADTs, fully utilising appropriate metalanguage. Criteria 1 Test Key knowledge: specification and uses of the following ADTs; list, array, dictionary, also known as an associative array, stack, queue, priority queue. Key skills: use ADTs in accordance with their specifications. For example student scores of 9–10, very high. Descriptors: Describes a new operation for one of the standard ADTs to accommodate requirements that cannot be satisfied by the standard definition.

Criterion 1 Test Key knowledge: specification and use of the graph abstract data type, including: cyclicity and connectedness as properties of graphs, weighted graphs, weighted path lengths and topological distance, trees and decision trees, directed graphs and directed acyclic graphs. Student scores at 9–10 which is very high, have the descriptor: Derives the graph property using the specified properties of graphs. That should say derives a new graph property using the specified properties of graphs.

Criterion 3 Test This test is on algorithms. So the key knowledge is: the basic structure of algorithms, pseudocode concepts including variables and assignment sequence, iteration, conditionals and functions, programming language constructs that directly correspond to pseudocode concepts, conditional expressions using the logic operations of, AND, OR and NOT, recursion and iteration and their uses in algorithm design, modular design of algorithms and ADTs. Key skills include: the interpret pseudocode and execute it manually on given input, write pseudocode, identify and correct errors in pseudocode, read and design appropriate recursive and iterative algorithms, write modular algorithms using ADTs and functional abstractions.

As for Criterion 1 Tests teachers must do three tests, must reference the criteria descriptors to set questions to assess the level of knowledge and skill from very low to very high. For example, students scores of 9-–10, very high, have the descriptor: Improves a piece of pseudocode by restructuring and modularisation using non-trivial user defined functions.

Criteria 3 Test Key knowledge: characteristics of algorithm design patterns, including brute-force search, greedy methods, decrease and conquer. Key skills: apply algorithm design patterns. Students scores of 9–10, very high, have the descriptor: Evaluates the suitability of an algorithm design pattern for a specific problem.

Criterion 3 Test Key knowledge: graph traversal techniques: breadth-first search, depth-first search and best-first search. Specification, correctness and limitations of the following graph algorithms: Prim's, Dijkstras', Bellman-Ford, Floyd-Warshall, transitive closure and shortest path and PageRank. Key skills: select appropriate graph algorithms and justify the choice based on their properties and limitations, demonstrate the correctness of the specified graph algorithms, use search methods on decision trees and graphs to solve planning problems. Students scores 9–10, which is very high. The descriptor: Describes a valid argument for the correctness of at least one of the specified graph algorithms using either the induction or contradiction method.

Folios are assessed against Criteria 2 and 4. They cover Outcome 1 and 2. 2–4 tasks are set early in the year and they are unlikely to assess the highest level of performance. Higher levels of performance can be assessed with the SAT project.

Criterion 2 Folios Key skills: use abstract data types in accordance with their specification, select and apply appropriate ADTs to model real-world problems, model basic network and planning problems with graphs. Teachers must reference the criteria descriptors to set folio tasks. For example, a student scores 9–10, very high, has the descriptor: Designs ADT representations, including the use of the graph ADT, for problems that have a structure that cannot be modelled fully using a single abstract data type. The design is fit for purpose and appropriately prioritises aspects of the problem that are most important to the specific context or the requirements of algorithms utilising the data structure.

Criteria 2 Folios Key skills: use ADTs in accordance with their specifications, select and apply appropriate ADTs to model real-world problems, model basic network and planning problems with graphs. Student scores of 9–10, very high, the descriptor: Fully represents a complex problem instance as a data model either in writing, graphically or within a programming environment.

Criterion 4 Folios Key skills: apply algorithm design patterns, select appropriate graph algorithms and justify the choice based on their properties and limitations. Again teachers must reference the criteria descriptors to set folio tasks to cover this aspect of assessment. For example, student scores 9–10, very high, the descriptor is: Selects a suitable algorithm design pattern for solving an information problem and applies the design pattern to design an algorithm to solve the problem.

Criteria 4 Folios Key skills: implement algorithms including graph algorithms as computer programs in a very high-level programming language that directly supports a graph ADT. Student scores of 9–10, very high: Uses a programming language to translate an algorithm, containing non-trivial functions, from pseudocode into program code. The project covers Outcomes 1, 2, and 3. The data model component is assessed through Criterion 2 and 6. The algorithm component is assessed through Criterion 4 and 6. The evaluation is assessed through Criterion 6 and 6. The SAT project would give students the opportunity to demonstrate to the highest levels within the Criteria 2 and 4.

Advice for the project. There should be a single coherent problem. What constitutes a good response to the problem may not be clear. There should be an obvious place to start for the data model with a simple graph-based data model solution, and there should also be a range of sophisticated data model solutions which require a combination of a graph and other abstract data types. There should be an obvious place to start for the algorithm, with a simple algorithmic solution, and there should also be a range of sophisticated algorithmic solutions that span several of the studied algorithms. No elements of the solution, such as choice of data structure of algorithm, should be specified in the problem description.

Criterion 2 Project Key skills include: use ADTs in accordance with their specification, select and apply appropriate ADTs to model real-world problems, model basic network and planning problems with graphs. Teachers must reference the criteria descriptors to assess the project task.

Criterion 4 of the Project The key skills are: apply algorithm design patterns, select appropriate graph algorithms and justify the choice based on their properties and limitations, implement algorithms including graph algorithms as computer programs in a very high-level programming language that directly supports a graph ADT. Teachers must reference the criteria descriptors to assess the project task.

Criteria 5 for the Project is Outcome 3 The key knowledge includes: characteristics and applicability of ADTs and algorithm design patterns, suitability of ADTs and algorithm design patterns for a variety of problem contexts, combination of ADTs to meet complex problem requirements. Key skills include: justify suitable ADTs and algorithm design patterns, evaluate the adequacy of a given combination of algorithms and ADTs for solving problems relative to other possible choices. Teachers again must reference the criterion descriptors to assess the project task.

Criteria 5 Project Key knowledge: induction and contradiction as methods of demonstrating the correctness of brute force, greedy methods and decrease and conquer algorithms. Key skills include: propose an argument for the correctness of an algorithm.

Criteria 6 for the Project Key skills include: communicate the design of data models and algorithms, communicate the meaning of computed solutions in terms of the original real-world problem to be solved. Teachers again must reference the criteria descriptors to assist the project tasks for this criterion.

Criteria 6 Project Key skills include: communicate the meaning of computed solutions in terms of the original real-world problem to be solved. Again teachers must reference the criteria descriptors to assess the project task. Authentication is covered in the next section.

You want to establish authentication of student work. The student progress needs to be recorded by the teacher with dates and comments. Teachers need to regularly observe student work during the life of the SAT tasks. Some teachers use one task, one class a week, sorry, to do this formally. Teachers must use the VCAA Authentication Record Form and update it with comments from observations as you go. These forms can be requested as part of the audit process. Both you and the student are to sign and date your initials for each observation at the time of the observation and for submission.

The next section we'll cover the assessment process for students' SAT tasks. This is the Algorithmics Assessment Sheet for Unit 3. Assists teachers to determine the score for each student on completion of a SAT. Teachers need to make judgements on student performance against each criteria by a score in the range of 0–10.

Any inquiries regarding the SAT assessment tasks can be made by contacting Phil Feain, Digital Technologies Curriculum Manager, VCAA, phone number 9059 5146 or email: Philip.Feain@education.vic.gov.au..

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