Digital Solutions subject report

2023 cohort

March 2024

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

240041

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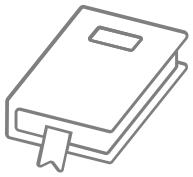
Introduction



Throughout 2023, schools and the Queensland Curriculum and Assessment Authority (QCAA) continued to improve outcomes for students in the Queensland Certificate of Education (QCE) system. These efforts were consolidated by the cumulative experience in teaching, learning and assessment of the current General and General (Extension) senior syllabuses, and school engagement in QCAA endorsement and confirmation processes and external assessment marking. The current evaluation of the QCE system will further enhance understanding of the summative assessment cycle and will inform future QCAA subject reports.

The annual subject reports seek to identify strengths and opportunities for improvement of internal and external assessment processes for all Queensland schools. The 2023 subject report is the culmination of the partnership between schools and the QCAA. It addresses school-based assessment design and judgments, and student responses to external assessment for this subject. In acknowledging effective practices and areas for refinement, it offers schools timely and evidence-based guidance to further develop student learning and assessment experiences for 2024.

The report also includes information about:

- how schools have applied syllabus objectives in the design and marking of internal assessments
- how syllabus objectives have been applied in the marking of external assessments
- patterns of student achievement.

The report promotes continuous improvement by:

- identifying effective practices in the design and marking of valid, accessible and reliable assessments
- recommending where and how to enhance the design and marking of valid, accessible and reliable assessment instruments
- providing examples that demonstrate best practice.

Schools are encouraged to reflect on the effective practices identified for each assessment, consider the recommendations to strengthen assessment design and explore the authentic student work samples provided.

Audience and use

This report should be read by school leaders, subject leaders and teachers to:

- inform teaching and learning and assessment preparation
- assist in assessment design practice
- assist in making assessment decisions
- help prepare students for internal and external assessment.

The report is publicly available to promote transparency and accountability. Students, parents, community members and other education stakeholders can use it to learn about the assessment practices and outcomes for senior subjects.

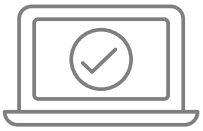
Report preparation

The report includes analyses of data and other information from endorsement, confirmation and external assessment processes. It also includes advice from the chief confirmer, chief endorser and chief marker, developed in consultation with and support from QCAA subject matter experts.

Subject highlights

164
schools offered Digital Solutions

78.59%
of students completed 4 units



94.3%
of students received a C or higher

Subject data summary

Subject completion

The following data includes students who completed the General subject.

Note: All data is correct as at January 2024. Where percentages are provided, these are rounded to two decimal places and, therefore, may not add up to 100%.

Number of schools that offered Digital Solutions: 164.

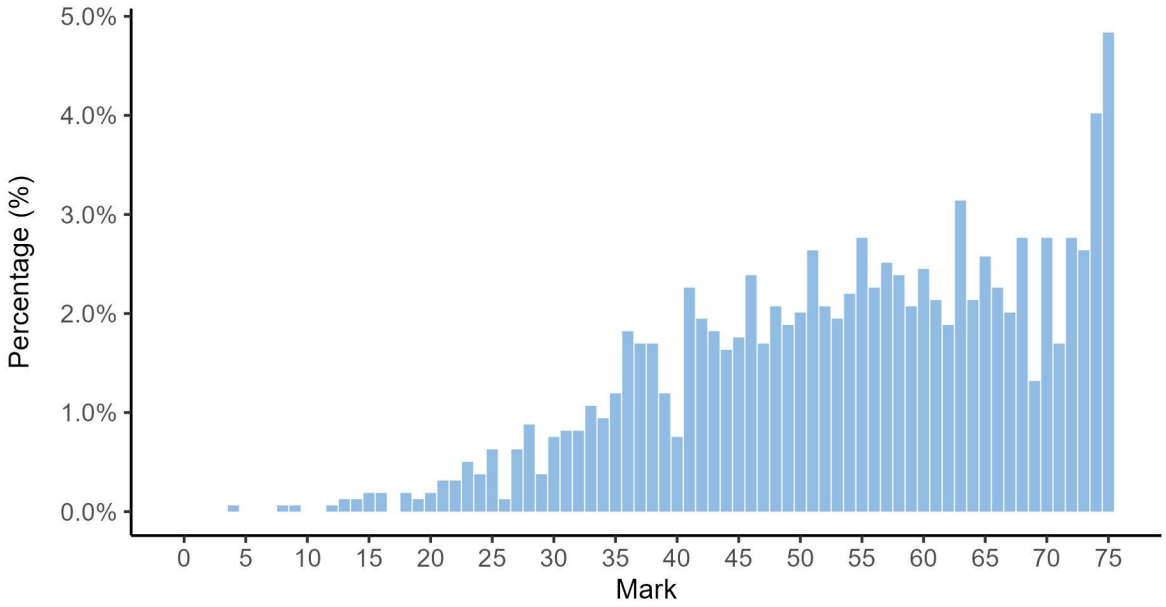
Completion of units	Unit 1	Unit 2	Units 3 and 4
Number of students completed	2,008	1,849	1,578

Units 1 and 2 results

Number of students	Satisfactory	Unsatisfactory
Unit 1	1,796	212
Unit 2	1,666	183

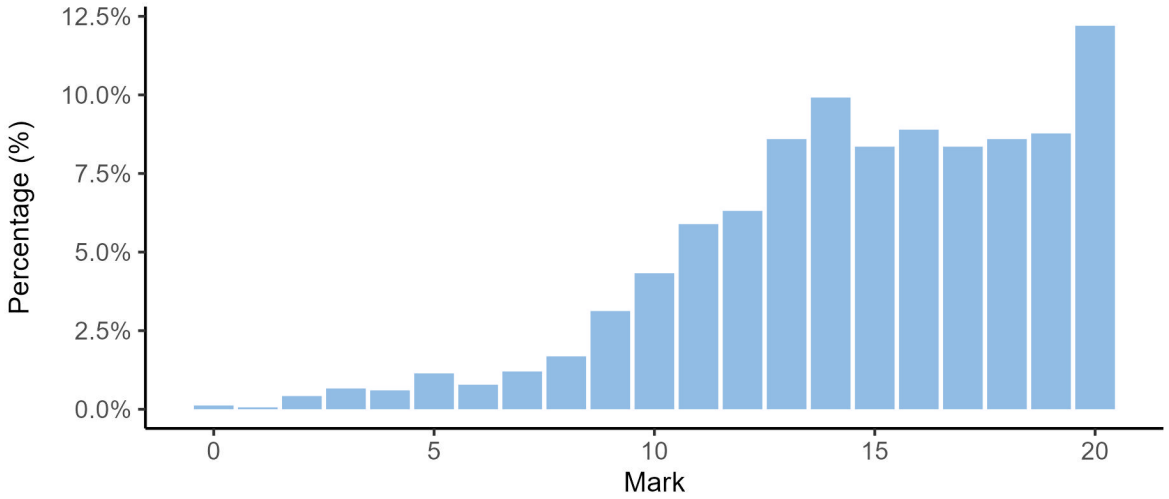
Units 3 and 4 internal assessment (IA) results

Total marks for IA

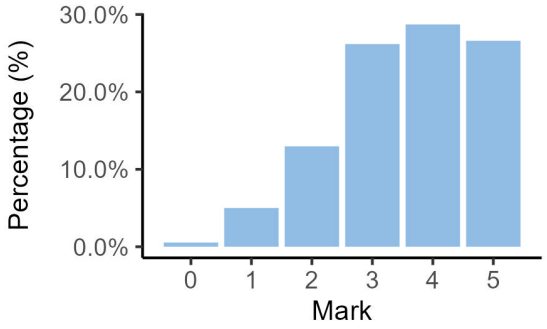


IA1 marks

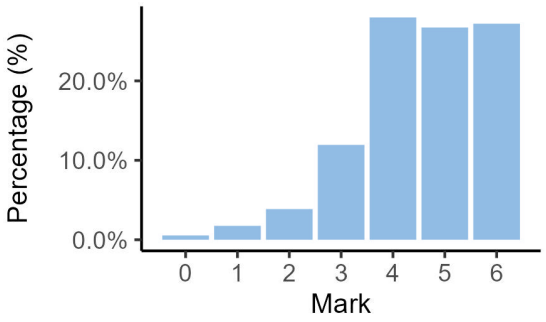
IA1 total



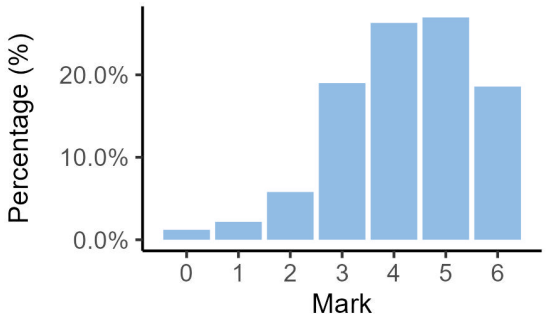
IA1 Criterion: Retrieving and comprehending



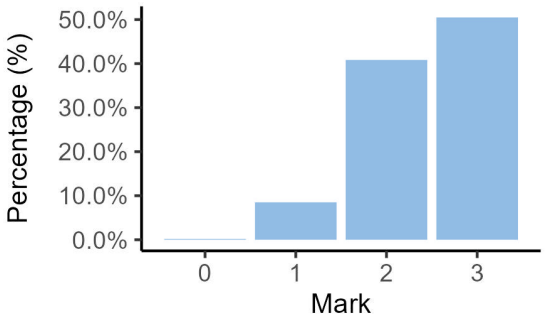
IA1 Criterion: Analysing



IA1 Criterion: Synthesising and evaluating

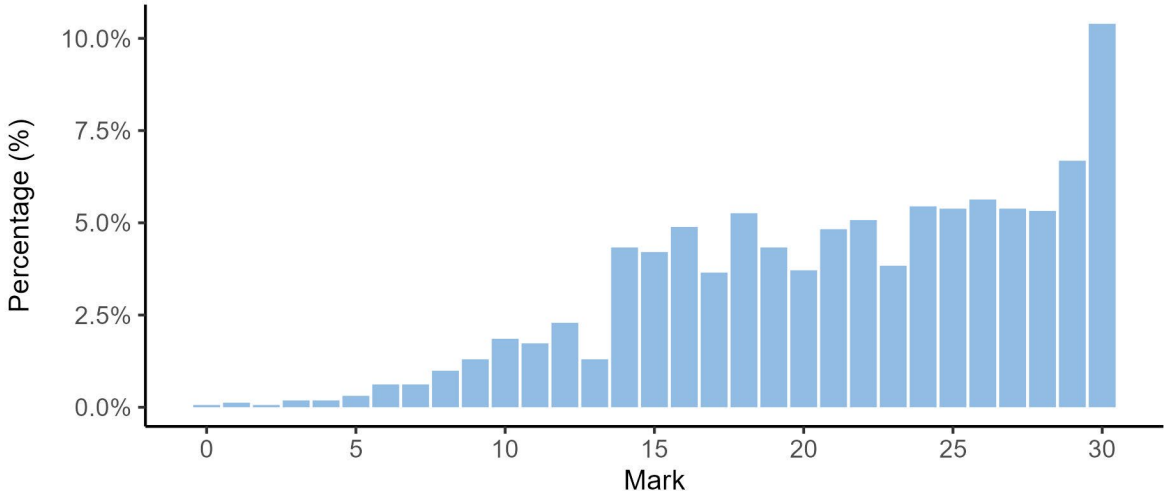


IA1 Criterion: Communicating

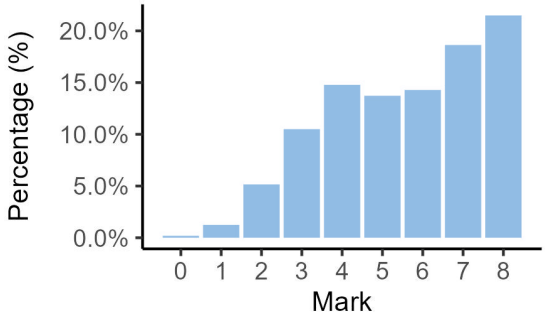


IA2 marks

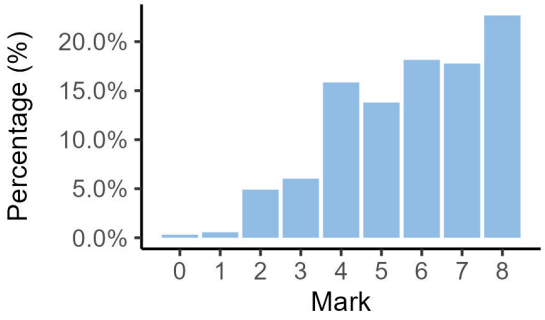
IA2 total



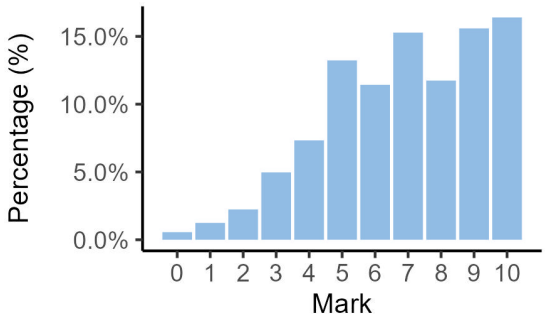
IA2 Criterion: Retrieving and comprehending



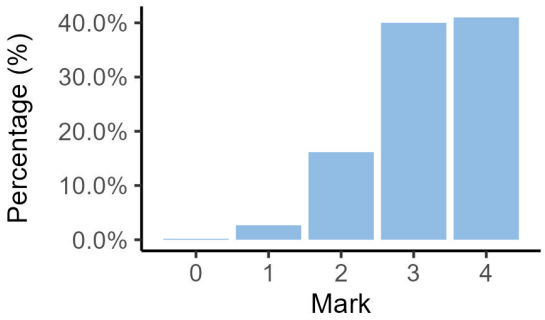
IA2 Criterion: Analysing



IA2 Criterion: Synthesising and evaluating

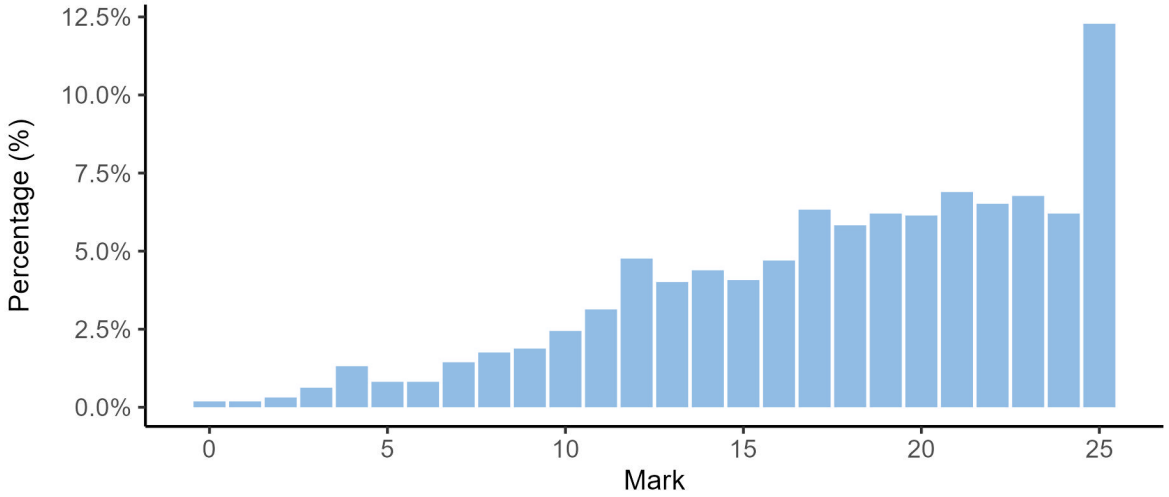


IA2 Criterion: Communicating

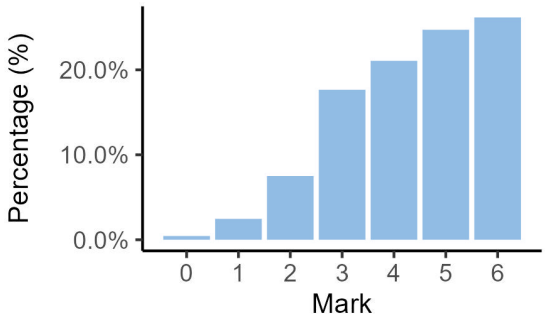


IA3 marks

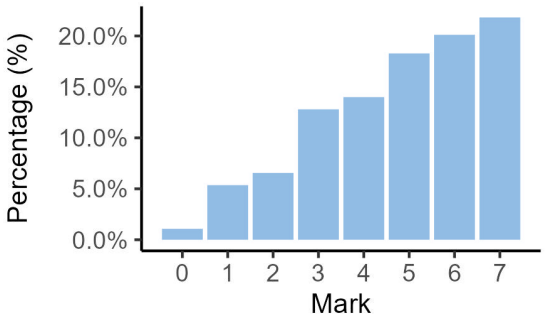
IA3 total



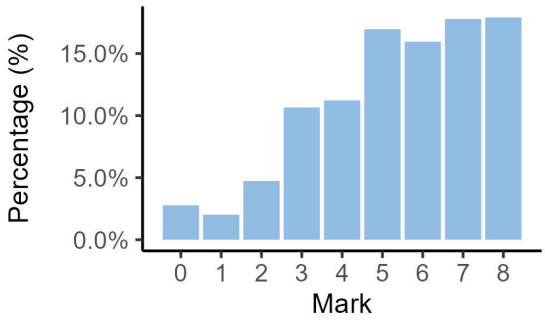
IA3 Criterion: Retrieving and comprehending



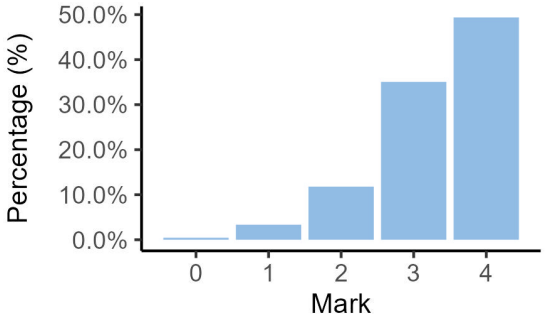
IA3 Criterion: Analysing



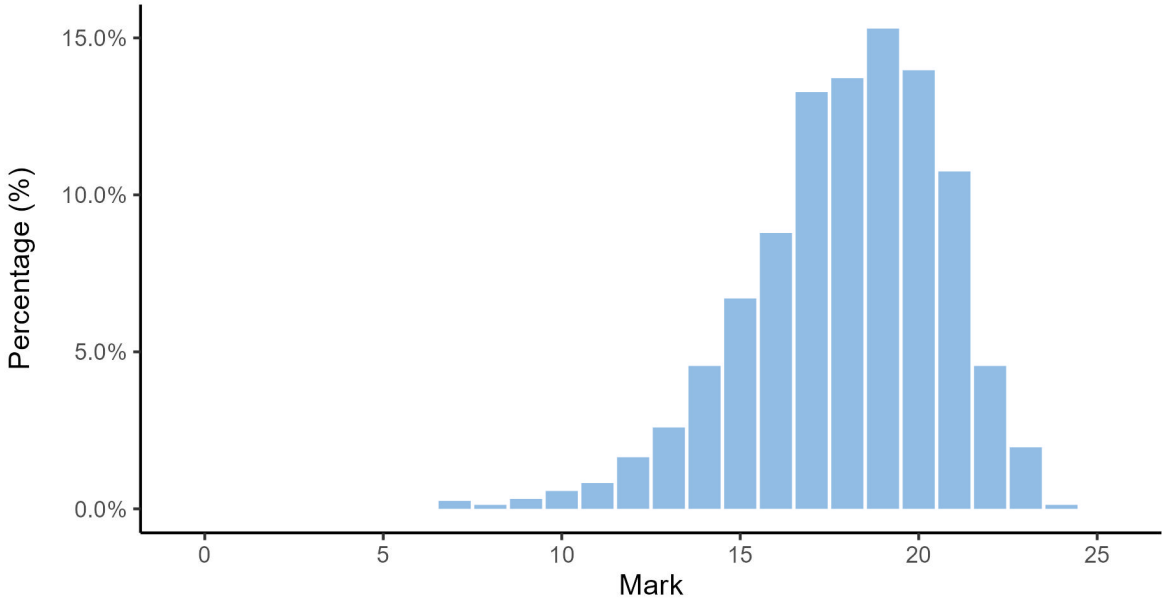
IA3 Criterion: Synthesising and evaluating



IA3 Criterion: Communicating

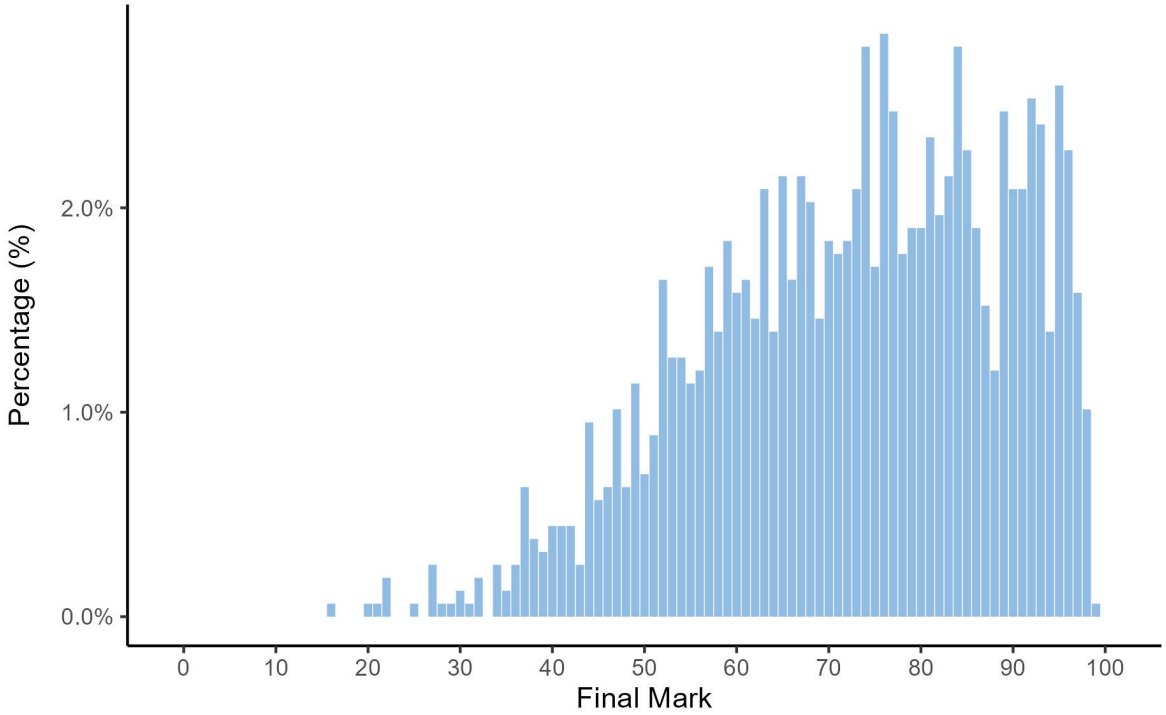


External assessment (EA) marks



Final subject results

Final marks for IA and EA



Grade boundaries

The grade boundaries are determined using a process to compare results on a numeric scale to the reporting standards.

Standard	A	B	C	D	E
Marks achieved	100-84	83-67	66-45	44-19	18-0

Distribution of standards

The number of students who achieved each standard across the state is as follows.

Standard	A	B	C	D	E
Number of students	477	553	458	89	1

Internal assessment

The following information and advice relate to the assessment design and assessment decisions for each IA in Units 3 and 4. These instruments have undergone quality assurance processes informed by the attributes of quality assessment (validity, accessibility and reliability).

Endorsement

Endorsement is the quality assurance process based on the attributes of validity and accessibility. These attributes are categorised further as priorities for assessment, and each priority can be further broken down into assessment practices.

Data presented in the Assessment design section identifies the reasons why IA instruments were not endorsed at Application 1, by the priority for assessments. An IA may have been identified more than once for a priority for assessment, e.g. it may have demonstrated a misalignment to both the subject matter and the assessment objective/s.

Refer to *QCE and QCIA policy and procedures handbook v5.0*, Section 9.6.

Percentage of instruments endorsed in Application 1

Number of instruments submitted	IA1	IA2	IA3
Total number of instruments	162	162	162
Percentage endorsed in Application 1	40%	30%	56%

Confirmation

Confirmation is the quality assurance process based on the attribute of reliability. The QCAA uses provisional criterion marks determined by teachers to identify the samples of student responses that schools are required to submit for confirmation.

Confirmation samples are representative of the school's decisions about the quality of student work in relation to the instrument-specific marking guide (ISMG), and are used to make decisions about the cohort's results.

Refer to *QCE and QCIA policy and procedures handbook v5.0*, Section 9.7.

The following table includes the percentage agreement between the provisional marks and confirmed marks by assessment instrument. The Assessment decisions section of this report for each assessment instrument identifies the agreement trends between provisional and confirmed marks by criterion.

Number of samples reviewed and percentage agreement

IA	Number of schools	Number of samples requested	Number of additional samples requested	Percentage agreement with provisional marks
1	157	950	33	82.8%
2	158	952	11	66.46%
3	157	940	11	71.34%

Internal assessment 1 (IA1)

Investigation — technical proposal (20%)

This assessment requires students to research a specific problem through collection, analysis and synthesis of information. A technical proposal uses research or investigative practices to assess a range of cognitions in a particular context. Research or investigative practices include locating and using information beyond students' own knowledge and the data they have been given.

Students must adhere to research conventions, including citations, reference lists or bibliographies. This assessment occurs over an extended and defined period of time. Students may use class time and their own time to develop a proposal and identify a low-fidelity prototype digital solution.

Assessment design

Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	27
Authentication	9
Authenticity	40
Item construction	16
Scope and scale	36

*Each priority might contain up to four assessment practices.

Total number of submissions: 162.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- identified at least two accessible data sources by providing hyperlinks, screenshots or samples of locally generated data
- defined a range of appropriate authentication strategies from the suggestions in the Endorsement application (app), including a clear draft submission checkpoint
- identified a context that related to the subject matter and provided a clear overview and framework for the task.

Practices to strengthen

It is recommended that assessment instruments:

- provide students with the opportunity to demonstrate the required assessable objectives and performance-level descriptors of the ISMG, e.g. determine prescribed criteria
- identify in the task description a single specific technology context from the table in the Unit 3 description (Syllabus section 4.1), remembering that students must address both the subject matter and the components of the digital solution in the selected technology context
- manage the scope and scale of the task by providing direct links to datasets or including specific search terms for a data portal and limiting the number of datasets students are required to analyse and/or integrate for their technical proposal.

Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	1
Language	1
Layout	11
Transparency	0

*Each priority might contain up to four assessment practices.

Total number of submissions: 162.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided clear and concise task instructions using the language of the syllabus, with minimal distractors
- used correct spelling and grammar, especially for technical terms that could alter the meaning of the instruction if misspelt
- described contexts that did not place students in professional roles outside the scope of their knowledge and experience.

Practices to strengthen

It is recommended that assessment instruments:

- reflect the hierarchy of the list of assessable evidence from the syllabus specifications (Syllabus section 4.6.1). Assessable evidence can be reworded for clarity but should not contradict or confuse the meaning and emphasis described in the syllabus. For instance, list ‘generation of a low-fidelity (non-coded) prototype solution’ as a separate item, rather than a sub-item of ‘synthesis of information and ideas to select the best approach for’, as
  - keeping synthesis of information and ideas separate will allow for more detailed evidence to support decisions about the proposed solution

- this provides the opportunity for students to demonstrate the selection of the best approach for data and coded components more explicitly.

Additional advice

- The level of detail provided in the context, task and stimulus sections can limit the scope of data sources and serve as prescribed criteria for the task, e.g. specifying personal, social or economic needs that may apply to the context or problem scenario.
- Use the scaffolding section of the task more effectively to tailor communication of the Digital Solutions problem-solving process and/or response format guidelines using language accessible to students (e.g. by providing scaffolding contextualised to the school environment, cohort and available resources) rather than copying the definition of a multimodal presentation from the syllabus (*QCE and QCIA policy and procedures handbook v5.0*, Section 8.2.3).
- Take care when copying and pasting assessable evidence to ensure list hierarchy is maintained. While editing the lists to offer better clarity is an acceptable practice, schools are advised to check for errors that may have occurred through the process of copying and pasting content between applications or other tasks.

Assessment decisions

Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Retrieving and comprehending	89.81%	8.28%	1.27%	0.64%
2	Analysing	88.54%	8.92%	1.91%	0.64%
3	Synthesising and evaluating	87.9%	11.46%	0.64%	0%
4	Communicating	94.9%	3.18%	1.91%	0%

Effective practices

Accuracy and consistency of the application of the ISMG for this IA was most effective when:

- for the Retrieving and comprehending criterion
  - accurate and discriminating recognition and description of data sources was demonstrated by exploring data sources to show understanding of relational and flat file data structures, and comparison of different file formats and data structures appropriate to the context (Syllabus section 4.4)
- for the Analysing criterion
  - insightful analysis to identify elements and features of data was demonstrated by determining file formats and data structures appropriate to the technology context (Syllabus section 4.4)

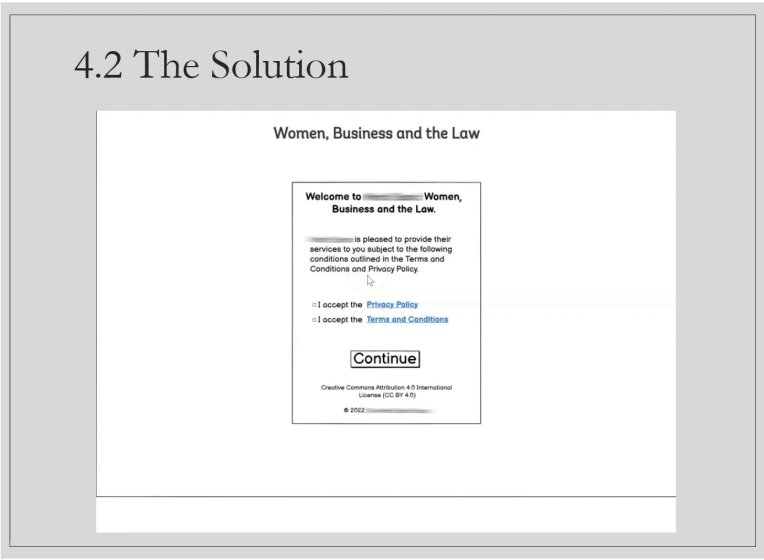
- for the Communicating criterion
  - discerning decision-making and fluent use of
    - written and visual features to communicate about a solution were demonstrated when responses did not exceed the response length conditions of the task as specified by the syllabus
    - investigation conventions included locating and using information beyond students' own prior knowledge and the data they had been given (Syllabus section 4.6)
  - judgments about referencing and project conventions were independent to matching characteristics to student work in the Retrieving and comprehending criterion, such as pseudocode and data flow diagrams for symbolisation conventions.

Samples of effective practices

The following excerpt demonstrates how purposeful generation of a technical proposal for relevant user interfaces and algorithm components is supported by:

- accurate and discriminating recognition and descriptions
- insightful analysis to identify elements and features of data.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.



Video content: (2 mins, 57 secs)
www.qcaa.qld.edu.au/curriculum-assessment/portal/media/sr-2023/snr_digital_solutions_ia1_e1.mp4

Practices to strengthen

To further ensure accuracy and consistency of the application of the ISMG in this IA, it is recommended that:

- when matching evidence to the characteristics for the Synthesising and evaluating criterion, attention should be given to
  - the critical evaluation of impacts, considering that this is clearly demonstrated when responses first determine possible personal, social and economic impacts relevant to the

real-world identified problem. The evaluation of impacts, components and low-fidelity prototypes is ensured when the evidence demonstrates that this is done against the prescribed and self-determined criteria in order to measure the overall success and suitability of the solution, and to make refinements and justified recommendations, e.g. recommending future improvements to user interface and/or programmed components to minimise identified personal impacts.

Additional advice

- Schools should ensure the video submission is of a sufficient quality, especially for diagrams and audio, e.g. the scale of images or the output resolution of files should not render the details of the images or diagrams illegible or difficult to interpret or understand. Submissions should align to the relevant *Confirmation submission information* (*QCE and QCIA policy and procedures handbook v5.0*, Section 9.7.1). The *Confirmation submission information* for Digital Solutions is available in the Syllabuses app in the QCAA Portal.
- Schools should review the *Making judgments* webinar in the QCAA Portal. When used in conjunction with subject report advice and excerpts that show student work matched to specific characteristics, this will develop knowledge and understanding of the demarcation between performance levels.
- Schools should refer to Sections 7.4 and 9.6.6 of the *QCE and QCIA policy and procedures handbook v5.0* for information about when amendments and comparable assessment are required. The administration of an endorsed task with annotated changes to the task (e.g. adjusting the task when a data source or essential resource becomes unavailable) that has not been reviewed through the amendment process risks the validity, accessibility and reliability of the task and equity for students.
- The school's assessment policy regarding managing response lengths should be reflective of the strategies outlined in the *QCE and QCIA policy and procedures handbook v5.0* (Section 8.2.6). When a student response exceeds assessment conditions, the strategy that has been applied by the teacher should be consistently and clearly indicated on the ISMG.
- Schools are responsible for gathering evidence of student achievement in response to the endorsed assessment in the required mode of delivery (*QCE and QCIA policy and procedures handbook v5.0*, Section 8.2.7). IA1 requires a 9–11-minute video submission. It may not be possible to equitably determine which portion of a non-video submission contributes 9–11 minutes of response time. This may result in the response being awarded marks for communication only or a NR result.

Internal assessment 2 (IA2)

Project — digital solution (30%)

This assessment focuses on the problem-solving process in Digital Solutions that requires the application of a range of cognitive, technical and creative skills and theoretical understandings. The response is a coherent work that documents the iterative process undertaken to develop a solution to a technical proposal. It may include written paragraphs and annotations, diagrams, sketches, drawings, and components of a prototype digital solution.

This assessment occurs over an extended and defined period of time. Students may use class time and their own time to develop a response.

Assessment design

Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	77
Authentication	11
Authenticity	12
Item construction	16
Scope and scale	7

*Each priority might contain up to four assessment practices.

Total number of submissions: 162.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- specified a Unit 3 technology context in the task description that matched the technology context from IA1, e.g. web application, mobile application, interactive media, intelligent system. It is acceptable for a task to identify the technology context by identifying a specific example, e.g. simulations, digital games, learning objects, productivity applications for interactive media (Syllabus section 4.1)
- clearly specified one complete draft checkpoint (*QCE and QCIA policy and procedures handbook v5.0*, Section 8.2.5)
- included a detailed technical proposal PDF attachment with headings and content aligned with the syllabus, i.e. identification, interactions, component specifications (Syllabus section 4.6.2)
- provided clear prescribed criteria in the task description or technical proposal to manage the scope and scale of the digital solution, i.e. determination of prescribed criteria, that would directly inform synthesis of information and ideas, and evaluation.

Practices to strengthen

It is recommended that assessment instruments:

- provide data specifications for specific external datasets aligned with Unit 3 subject matter, including relational and flat file data structures, and file formats and data structures appropriate to the technology context (Syllabus section 4.4)
- include working hyperlinks or high-quality, legible sample images of datasets with tasks. Access to datasets is an important part of the endorsement process to determine suitable scope and scale and checking of other validity practices for assessment.

Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	2
Language	6
Layout	26
Transparency	8

*Each priority might contain up to four assessment practices.

Total number of submissions: 162.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- provided a stimulus that contained minimal distractors and was accessible to all students
- avoided the use of jargon and colloquialisms outside the scope of students' local context
- used the language of the syllabus in the context, task and stimulus with explicit links to assessment specifications, objectives and the ISMG.

Practices to strengthen

It is recommended that assessment instruments:

- include a complete list of all assessable evidence from the specifications (Syllabus section 4.6.2), reflecting the syllabus list hierarchy. Assessable evidence can be reworded for clarity but should not contradict or confuse the meaning and emphasis described in the syllabus. For instance, a suitable reworded variation might include:
  - symbolise
    - the user and developer problem using mind maps and one or more of constructed sketches, annotated diagrams, images or screenshots
    - algorithms communicated in pseudocode that demonstrate knowledge and understanding of programming features
    - interrelationships between user experiences and data in the prototype web application using one or more of constructed sketches, annotated diagrams, images or screenshots.

Assessment decisions

Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Retrieving and comprehending	79.11%	18.99%	1.27%	0.63%
2	Analysing	82.91%	16.46%	0.63%	0%
3	Synthesising and evaluating	79.11%	12.66%	0%	8.23%
4	Communicating	87.34%	10.76%	1.9%	0%

Effective practices

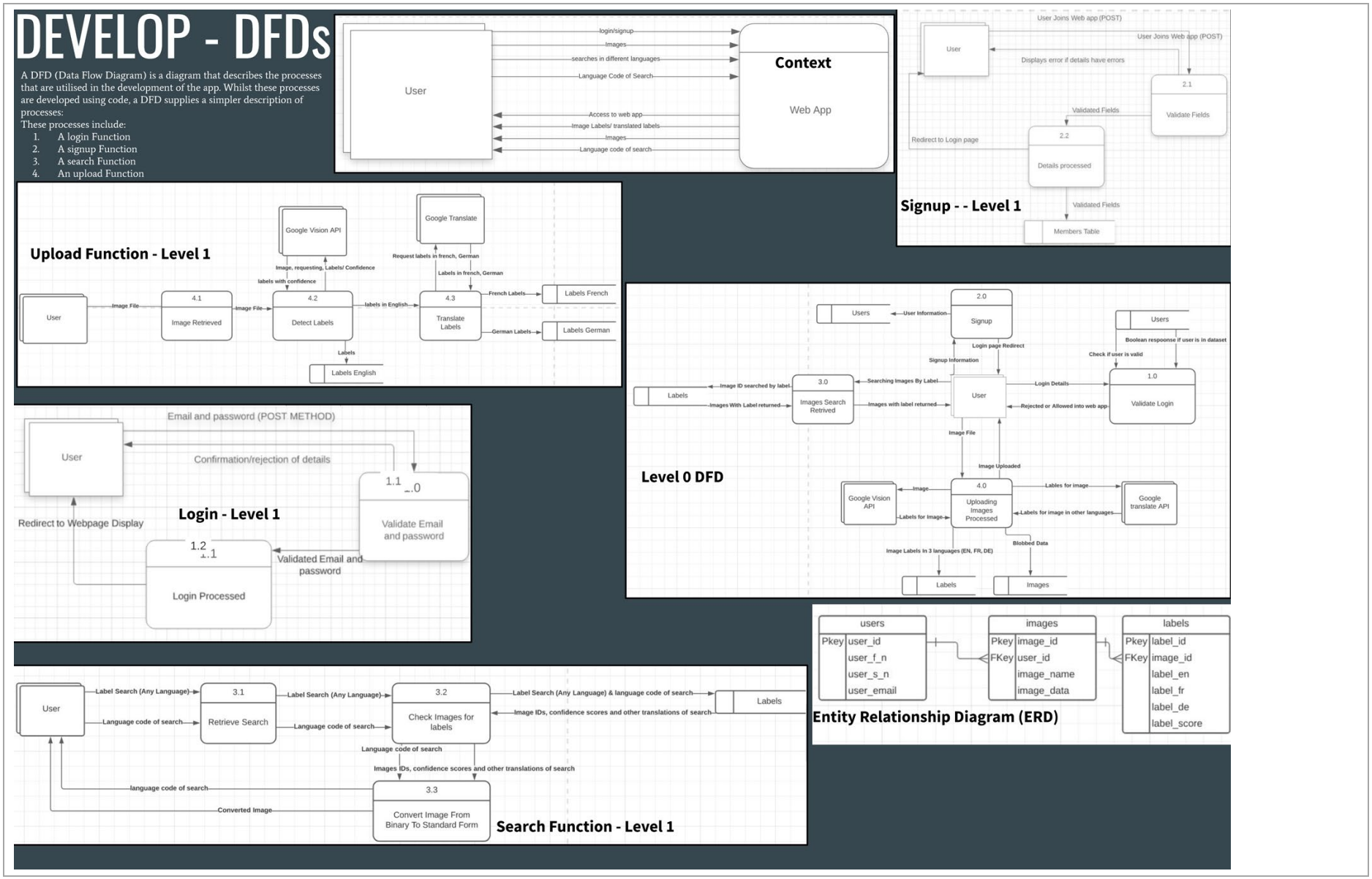
Accuracy and consistency of the application of the ISMG for this IA was most effective when:

- for the Communicating criterion
  - responses included a reference list and in-text referencing for information, ideas or visual features where necessary, including self-referencing for aspects of a previously submitted response, e.g. the analysis of a data source.

Samples of effective practices

The following excerpt demonstrates adept symbolisation and discerning explanation of data structures and interrelationships between user experiences and data of the digital prototype.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.


DEVELOP - DFDs
A DFD (Data Flow Diagram) is a diagram that describes the processes that are utilised in the development of the app. Whilst these processes are developed using code, a DFD supplies a simpler description of processes:
These processes include:
1. A login Function
2. A signup Function
3. A search Function
4. An upload Function
User
login/signup
Images
searches in different languages
Language Code of Search
Access to web app
Image Labels/ translated labels
Images
Language code of search
Context
Web App
User Joins Web app (POST)
User
Displays error if details have errors
2.1
Validate Fields
Validated Fields
Redirect to Login page
2.2
Details processed
Validated Fields
Members Table
Signup - - Level 1
Upload Function - Level 1
Google Vision API
Google Translate
Request labels in french, German
Image, requesting, Labels/ Confidence
Labels in french, German
labels with confidence
User
Image File
4.1
Image Retrieved
Image File
4.2
Detect Labels
labels in English
4.3
Translate Labels
French Labels
Labels French
German Labels
Labels German
Labels
Labels English
Email and password (POST METHOD)
User
Confirmation/rejection of details
1.1
Validate Email and password
Redirect to Webpage Display
Login - Level 1
1.2
Login Processed
Validated Email and password
Users
User Information
2.0
Signup
Login page Redirect
Signup Information
Users
Boolean respoonse if user is in dataset
Check if user is valid
1.0
Validate Login
Labels
Image ID searched by label
Images With Label returned
3.0
Images Search Retrived
Searching Images By Label
Images with label returned
User
Login Details
Rejected or Allowed into web app
Image File
Image Uploaded
Level 0 DFD
Google Vision API
Image
4.0
Uploading Images Processed
Labels for image
Labels for image in other languages
Google translate API
Blobbed Data
Image Labels in 3 languages (EN, FR, DE)
Labels
Images
users
Pkey user_id
user_f_n
user_s_n
user_email
images
Pkey image_id
FKey user_id
image_name
image_data
labels
Pkey label_id
FKey image_id
label_en
label_fr
label_de
label_score
Entity Relationship Diagram (ERD)
User
Label Search (Any Language)
Language code of search
3.1
Retrieve Search
Label Search (Any Language)
Language code of search
3.2
Check Images for labels
Label Search (Any Language) & language code of search
Image IDs, confidence scores and other translations of search
Labels
Language code of search
Images IDs, confidence scores and other translations of search
language code of search
Converted Image
3.3
Convert Image From Binary To Standard Form
Search Function - Level 1

The following excerpt demonstrates critical evaluation of impacts against prescribed and self-determined criteria.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

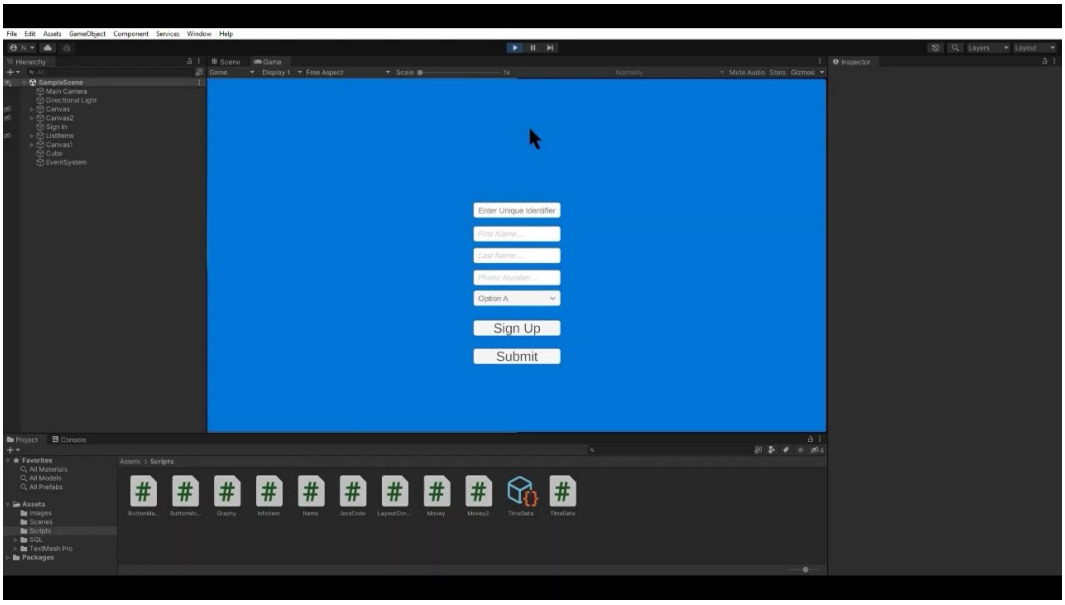
Impacts

Impact: Users, like the three developed personas, will obtain direct personal impacts, benefiting from being able to easily find parks for their desired location and needs. Forty-eight percent of people find parking stressful (Automotive Fleet, 2022) and the average Australian spends 14 hours per year looking for a park, with 18-24 year-old drivers taking the more time than any other age-group (Wong, 2017). Hence, by enabling users to plan ahead and identify parking locations, along with providing the expected vacancy and calculated cost, the application can reduce stress in regards to parking, the cost of parking in the city and improve punctuality of users. This appeals directly to the values and stresses of users, like Patricia and Kate, also indirectly allowing users, like Simon and Patricia to feel a sense of success. Primarily, users' initial satisfaction from the provided information and ease of navigation are key measures of success -- best indicating potential future use and determining the general accessibility, understandability and relevance of the provided information to users. User satisfaction surveys with respect to the application and parking in the Brisbane area could potentially indicate longer term satisfaction as well.
Evaluation: Based on user testing, the developed solutions achieves these benefits, though longer term testing should be conducted. By prioritising the estimated cost, location of parking locations and predicted occupancy within the summary information and map pages -- users can efficiently locate information they would like, justified by user testing. Users with different profiles were assessed, with an overall high rating of their experience and all stating they would use the application again (Appendix C). This successfully indicates potential future-use, working to achieve this benefit. By setting the default times and date inputs on the landing page to the current time and date, users, like Patricia, can search quickly and efficiently with less stress and input fields to fill out, while the inputs also allow users, like Kate or Simon, to plan ahead. Additionally, the user testing in Appendix C indicated a relatively high usability and accessibility (which improved after refinements were made), suggesting this benefit will be achieved through the developed solution.

Impact: Users, such as Patricia and her customer Pauline, will receive direct personal benefits, by the provided knowledge of disability parking locations reducing time needed to find a park. By differentiating and filtering for different types of parks, e.g. disability permit parking, the application can allow users to easily identify specific parks for their needs, like Patricia looking for disability parking; Kate for motorcycle parking. This can be measured by users' ease and initial satisfaction of finding specific parking types with the filterable map. Additionally, continued use of this feature and user satisfaction surveys in regards to it can indicate longer term success.
Evaluation: By using a select tag for the filter, values can be considered through conditional statements -- with different queries based on the required data. As the drop-down is a familiar design feature, it is easily learnable and users were able to easily use the feature. Users like Kate, looking for motorcycle parking locations, were more successful than Patricia looking for disability parking locations however. This is because there were not many disability parks in the disability permit parking location dataset -- however, for Pauline and Patricia's pre-arranged situation this may be ok. The filter is applied effectively by utilising fetch() and .then to retrieve the current state of the input fields on the client side, before processing the changes by re-generating the data required for the map on the server side. Hence, as the whole page does not have to be re-rendered this is more efficient. As a recommendation, the application could utilise session variables to store user preferences, for example the last state of the filter, such that the map does not have to initially load with car parking. This could improve the ease of use (utility), effectiveness and overall user satisfaction as less user input is required. However, as session variables were not utilised an alternative is setting the initial value as 'car' like in the developed solution -- as this is the most common parking requirement.

The following excerpt demonstrates a video demonstration of the functionality of a prototype digital solution to support purposeful generation of an efficient user interface and programmed components.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.



Video content (3 mins 25 secs)
www.qcaa.qld.edu.au/curriculum-assessment/portal/media/sr-2023/snr_digital_solutions_ia2_e1.mp4

Practices to strengthen

To further ensure accuracy and consistency of the application of the ISMG for this IA, it is recommended that:

- when matching evidence to characteristics for the Retrieving and comprehending criterion, attention is given to the symbolisation of data structures and the interrelationships between user experiences and data, and the different purposes of
  - data flow diagrams, which
    - symbolise the interrelationships between user experiences and data of the digital prototype
    - are a visual depiction of how information moves between different parts of a system, focusing on the processes and the interactions among them
  - entity relationship diagrams, which
    - focus on how data is structured within a system.
    - show the relationships between different entities (like tables in a database) and how they interact with one another, including primary and secondary keys and data types
    - in terms of matching evidence, contribute to the symbolisation of data structures as opposed to the interrelationships between user experiences and data

- when matching evidence to the characteristics for the Synthesising and evaluating criterion, attention is given to
  - responses explicitly demonstrating through real-time simulation that the user interface, data and programmed components have been combined to generate a functioning digital solution. Purposeful demonstration of efficient digital solution components, as well as effective and adequate generation of digital solution components, require more than static screenshots of components or code in the video recording as it is difficult to ascertain more than partial generation of the required components. The video recording is the only opportunity for students to demonstrate the functionality of the final solution and requires discerning decision-making about visual features to communicate about a solution
  - the critical evaluation of impacts by demonstrating analysis of the
    - merits and faults of the potential personal, social and economic impacts of the digital solution and consideration of these impacts in relation to the prescribed and self-determined criteria to inform justification of refinements and recommendations
    - accuracy and efficiency of coded components to identify errors, and analysis of the merits and faults of the user interface from a user-experience perspective, both in relation to the prescribed and self-determined criteria to inform justification of refinements and recommendations.

Additional advice

- Schools are reminded that
  - the Communicating criterion does not require students to speak or include verbal communication in the video demonstration of functionality. However, students should be advised to consider the most discerning way to use written and visual features to communicate the functionality of the generated digital solution, e.g. annotations or captions to provide additional information to describe or explain features, a list of key features that includes timestamps to point out key features (Syllabus section 4.6.2)
  - judgment about the symbolisation of algorithms is predominantly concerned with how well pseudocode shows how a computing algorithm should and could work. The syllabus states that there is no standard format for pseudocode and that it varies between programmers. While there are conventions that provide examples of how pseudocode may be implemented (Syllabus section 1.2.5), it is the subject matter that describes the important aspects to consider when making judgments about the symbolisation of algorithms. Some conventions apply only to typed pseudocode (e.g. the use of ‘bold capitals’). The syllabus conventions provide scope for the use of keywords that are different from the examples provided (e.g. START instead of BEGIN) since keywords do not have to be valid programming language, as long as they clearly convey the intention of the line of pseudocode. Students should consider the importance of symbolising the declaration of variables and relevant user interaction, data input and output with pseudocode
  - decision-making about and use of written features refer to descriptions and explanations, as these are the cognitions associated with the Communicating criterion, whereas symbolisation of algorithms is associated with the Retrieving and comprehending criterion. When making judgments about the symbolisation of algorithms, consider the subject matter from Unit 3, Topic 2 with regard to the order and clarity of the algorithms and how well they communicate user interaction, data validation and data presentation (Syllabus section 4.4)
  - data flow diagrams must use the correct symbols for entities, processes and data stores as per the conventions in the syllabus, including the flow of data (Syllabus section 1.2.5)

- the best-fit approach is to be used consistently to ensure correct application when deciding performance levels and awarding marks for each criterion on the ISMG. Marked ISMGs should indicate the characteristics evident in the student response and the mark awarded for each criterion (*QCE and QCIA policy and procedures handbook v5.0*, Section 9.7.1). Further information is available in the QCAA Portal in
  - *Module 3 – Making reliable judgments* in the Assessment Literacy app
  - *Digital Solutions making judgments and using ISMG* support resources in the Syllabuses app.

Internal assessment 3 (IA3)

Project — folio (25%)

This assessment focuses on the problem-solving process in Digital Solutions that requires the application of a range of cognitive, technical and creative skills and theoretical understandings. The response is a coherent work that documents the iterative process undertaken to develop a solution to a problem. It may include written paragraphs and annotations, data, tables, algorithms, diagrams, sketches, illustrations, digital prototypes and models.

This assessment occurs over an extended and defined period of time. Students may use class time and their own time to develop the folio.

Assessment design

Validity

Validity in assessment design considers the extent to which an assessment item accurately measures what it is intended to measure and that the evidence of student learning collected from an assessment can be legitimately used for the purpose specified in the syllabus.

Reasons for non-endorsement by priority of assessment

Validity priority	Number of times priority was identified in decisions*
Alignment	13
Authentication	0
Authenticity	1
Item construction	15
Scope and scale	7

*Each priority might contain up to four assessment practices.

Total number of submissions: 162.

Effective practices

Validity priorities were effectively demonstrated in assessment instruments that:

- referenced a specific API, JSON or XML dataset in the technical proposal attachment or stimulus section of the task
- included a technical proposal aligned to the specifications of the syllabus. The syllabus states that teachers may prepare a technical proposal document as stimulus material for this assessment, which should contain headings and information for identification, interactions and component specifications (Syllabus section 5.6.1).

Practices to strengthen

It is recommended that assessment instruments:

- include an accessible link or screenshot of sample data in the stimulus, e.g. ensure links are not broken, or provide sample data for links if they are only accessible within a school environment. The datasets must be accessible to endorsers to determine the validity, scope and scale of stimulus

- identify a real-world problem relevant to both data exchange methods and data security. Tasks should identify a data exchange problem that provides the opportunity for students to effectively demonstrate subject matter related to data security, including security impacts of data and its use, dissemination, storage, accuracy and ownership on personal, social and economic needs, taking into consideration changes in interactivity and ways information and data are created, used and shared (Syllabus section 5.5).

Accessibility

Accessibility in assessment design ensures that no student or group of students is disadvantaged in their capacity to access an assessment.

Reasons for non-endorsement by priority of assessment

Accessibility priority	Number of times priority was identified in decisions*
Bias avoidance	0
Language	11
Layout	42
Transparency	5

*Each priority might contain up to four assessment practices.

Total number of submissions: 162.

Effective practices

Accessibility priorities were effectively demonstrated in assessment instruments that:

- used data sources that contained appropriate and accessible content
- provided clear instructions using language that was accessible to students and avoided industry jargon
- specified one clear technology context for the task.

Practices to strengthen

It is recommended that assessment instruments:

- use correct spelling, grammar and technical terms aligned with Unit 4 subject matter, e.g. simulate instead of stimulate
- maintain the list hierarchy for assessable evidence. Formatting errors such as misaligned bulleted lists can reduce clarity and change the meaning or emphasis of list components. Care should be taken to avoid separating cognitions into two separate stems where they are expressed as one stem in the syllabus (e.g. the symbolise and explain bullet points in Parts 1 and 2), so it is clear what students must symbolise.

Additional advice

- It is recommended that schools review the sample assessment instruments on the QCAA Portal as they have recently been updated to reflect best practice.
- Avoid copying and pasting directly into the Endorsement app when constructing a task without first removing all formatting and syllabus footer data.
- Provide scaffolding that is consistent with the instrument conditions, e.g. a page-by-page breakdown that does not exceed or reduce syllabus conditions for page count. Schools are

encouraged to provide scaffolding that is relevant and responsive to their individual context, which may call for a more general or flexible page breakdown for students, e.g. a range of pages for each part. Regardless of the page breakdown provided, ensure it is clear that students may include additional pages of documentation to make up the total 8–10 A3 pages and 2–4 A4 pages of annotated code in any part, where appropriate.

Assessment decisions

Reliability

Reliability is a judgment about the measurements of assessment. It refers to the extent to which the results of assessments are consistent, replicable and free from error.

Agreement trends between provisional and confirmed marks

Criterion number	Criterion name	Percentage agreement with provisional	Percentage less than provisional	Percentage greater than provisional	Percentage both less and greater than provisional
1	Retrieving and comprehending	87.26%	10.83%	1.27%	0.64%
2	Analysing	85.99%	12.74%	1.27%	0%
3	Synthesising and evaluating	79.62%	18.47%	1.27%	0.64%
4	Communicating	91.72%	5.73%	1.91%	0.64%

Effective practices

Accuracy and consistency of the application of the ISMG for this IA was most effective when:

- for the Retrieving and comprehending criterion
  - accurate and discriminating recognition and discerning description of
    - key elements of the application were contextualised to a specified technology context (e.g. web applications, mobile applications, interactive media, intelligent systems) and/or the real-world identified problem, including relevant elements of the user interface, data and coded components (e.g. an intelligent system may include sensors, unique networking elements, programming environments and languages)
    - components of data exchange systems were demonstrated through information about data sources, data types and sample data and its relevancy to the identified problem and were strengthened by explanations of data interface, structures and specifications. The descriptors in this criterion are interdependent, e.g. symbolised and explained data flow relationships provide further opportunity for students to demonstrate recognition and description of the components of data exchange systems
    - data security processes were highly contextualised to the identified real-world problem through research and investigative practices with consideration for solutions to similar problems. Investigating existing solutions also creates opportunities for students to demonstrate discerning decision-making about and fluent use of referencing conventions, particularly the use of in-text references when referring to features of existing solutions that have informed ideas and components

- adept symbolisation of algorithms demonstrated use of pseudocode to communicate algorithmic steps in a well-ordered, unambiguous manner with all the necessary constructs to communicate the intended inputs, processes and outputs to solve the identified problem. Adept symbolisation of algorithms considers how well responses have used a mixture of everyday language and programming conventions, specifically the use of keywords to indicate the basic control structures (e.g. assignment, sequence, selection, condition, iteration, modularisation) and textual indentation, to clearly communicate the algorithmic steps.

Samples of effective practices

The following excerpts have been included to demonstrate accurate and discriminating recognition and discerning description of data exchange components.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

Excerpt 1

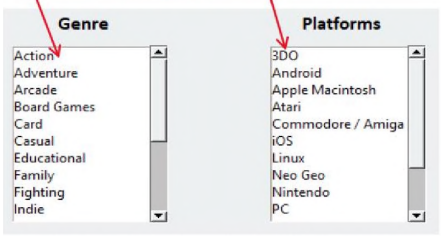
```
def getRawgList(rawgList):
    #function to get the genres from the RAWG API
    #returns a list of genres
    #rawgList is the URI of the list to be retrieved
    statusCode, apiResponse = rawg.rawgApiRequest(rawgList, '', 'ordering=name')
    if statusCode == 200:
        listArray = apiResponse['results']
        return listArray
    else:
        return "No data found"
```

Calls the rawgAPIRequest function

Selection used

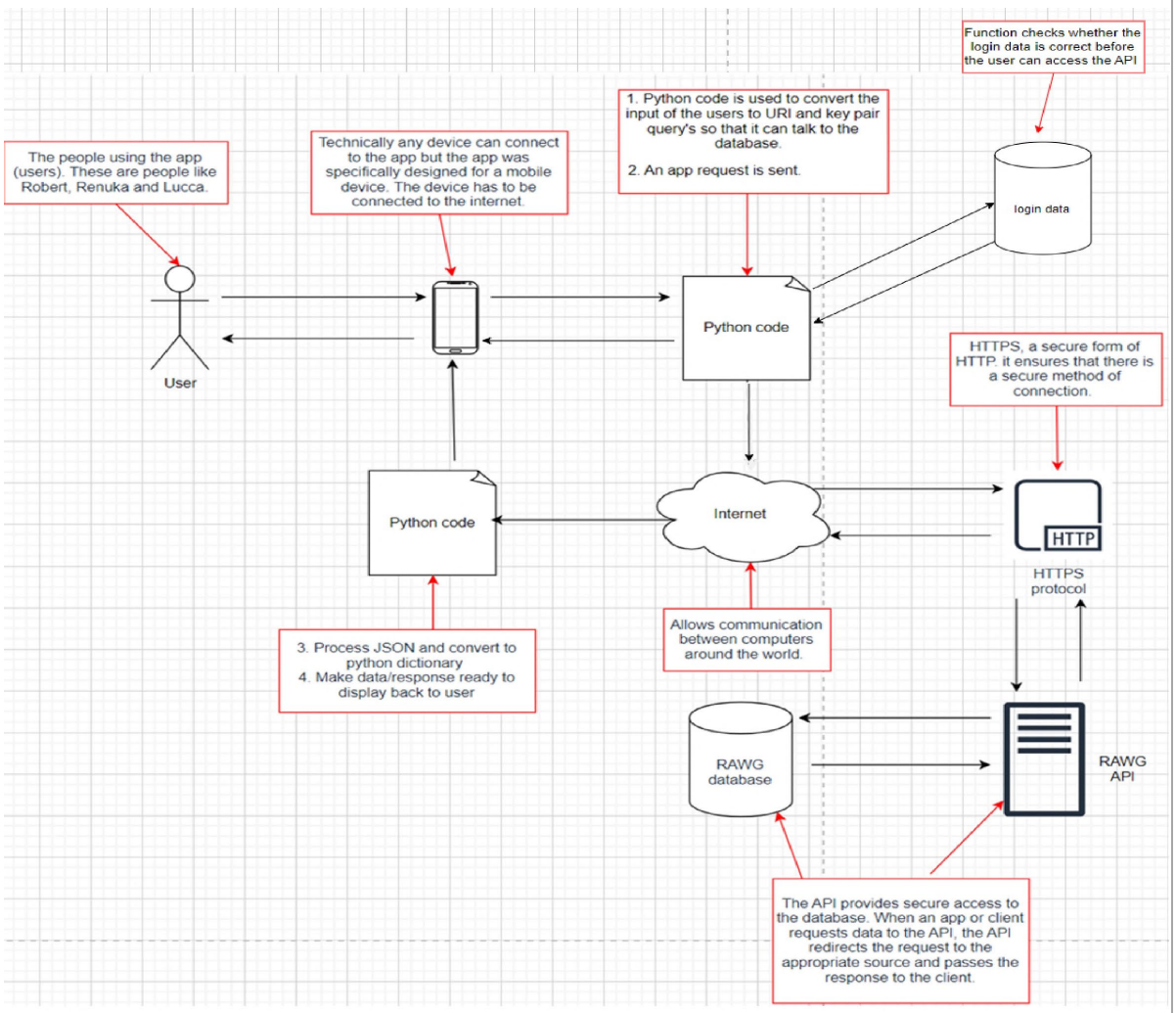
Returns an array of the names of the genres or platforms to be displayed in the list box

Uses response code once again



- This is a function that calls the previous function "rawgAPIRequest" so therefore it is connecting to the API
- This function is used to retrieve a complete list of genres to fill the list box which the users use to filter the data. Therefore, it just gets all the genres mentioned.
- It returns an array full of genre names
- The same function is used for the list box of platforms

Excerpt 2


Function checks whether the login data is correct before the user can access the API
1. Python code is used to convert the input of the users to URI and key pair query's so that it can talk to the database.
2. An app request is sent.
The people using the app (users). These are people like Robert, Renuka and Lucca.
Technically any device can connect to the app but the app was specifically designed for a mobile device. The device has to be connected to the internet.
login data
User
Python code
HTTPS, a secure form of HTTP. it ensures that there is a secure method of connection.
Python code
Internet
HTTP
HTTPS protocol
3. Process JSON and convert to python dictionary
4. Make data/response ready to display back to user
Allows communication between computers around the world.
RAWG database
RAWG API
The API provides secure access to the database. When an app or client requests data to the API, the API redirects the request to the appropriate source and passes the response to the client.

The following excerpt has been included to demonstrate insightful analysis of the data exchange problem and relevant information related to data security to identify risks to data and code components.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

Risks – Confidentiality	Confidentiality refers to the assurance that information is not disclosed to unauthorised persons, processes, or devices (What are Confidentiality, Integrity and Availability in Information Security?, n.d.). It protects data such as the data from the **RAWG API** from unauthorised access.
Threats	Malware: - Intrusive software designed to infect, steal, or execute malicious actions (Malware | What is Malware & How to Stay Protected from Malware Attacks, n.d.) Phishing: - Scammers impersonate trustworthy entities to trick recipients into sharing information (PHISHING ATTACKS AND HOW TO PROTECT AGAINST THEM, n.d.). Commonly executed via email spoofing and text messages. Code injection: - When scammers introduce malicious code into a computer program by taking advantage of a flaw in the program's functionality instructions or the way it interprets data (Weilin Zhong, n.d.). Supply Chain Attacks: - Cyber-attacks that target the software or hardware supply chain to compromise the product before it reaches the users. This is instead of directly attacking the target organisation but instead infiltrating and tampering with the components used in the supply chain. This can include anything from inserting malicious code into third-party libraries or compromising the physical hardware components.
Counter-measures	Encryption: A way of scrambling data so that only authorised parties can understand the information. - The process of converting plain text (readable by humans) to text that isn't understandable also known as cipher text (Cloudflare, 2022). Two-factor authentication: - uses more than two factors to authenticate a user before they can access resources or data. Two common types of authentication factors used are something that only the user physically has and something only the user will know. By using two or more methods of authentication, login security is increased, and threats to confidentiality are reduced. A good example, which is being used more regularly is sending a pin code via SMS to the user which they must then add as a second step to authenticate. Australian Privacy Principles (APPs): - The Australian Privacy Act 1988 mandates compliance when collecting personal information. It includes 13 APPs, with three key ones for data exchange: - APP 1: Requires managing personal information transparently with an updated privacy policy. - APP 6: Specifies when entities can use or disclose personal information. - APP 11: Ensures taking reasonable steps to safeguard personal information from misuse, loss, or unauthorized access, and may require destruction or de-identification in certain cases.
Data exchange requirements	To maintain confidentiality within the **digital solution for EB Games**, data will be protected by using encryption, two-factor authentication, and adherence to APPs. These measures secure information for users like **Robert, Lucca, and Renuka**, preventing unauthorized disclosure and ensuring data integrity and privacy in the **digital solution**.

The following excerpt has been included to demonstrate adept symbolisation of algorithms.

Note: The characteristic/s identified may not be the only time the characteristic/s has occurred throughout a response.

PART 2: DATA EXCHANGE SOLUTION

3.0 DEVELOPMENT

3.1 CONCEPTUALISING THE SOLUTION

As Jordan and Dani were selected as the target proto-personas, it was decided that a competitive puzzle game would be made. For this, inspiration was taken from "Cube" by Simon Tatham, and it was decided that a game titled "Tile Tessellator" would be created. The game would consist of a 3D board and cube, where users must rotate their cubes around, collecting tiles in either the least number of moves, or the least amount of time. Having multiple game modes would also add variety to the gameplay, making it more entertaining to play. It was also decided that a "Dad Joke" REST API would be used as the second digital system, to add some entertainment to the main menu, and that a relational database would be used over a flat file system, to increase the efficiency of the solution. The solution development plans were then explored through the diagrams below.

3.2 DIVIDE AND CONQUER

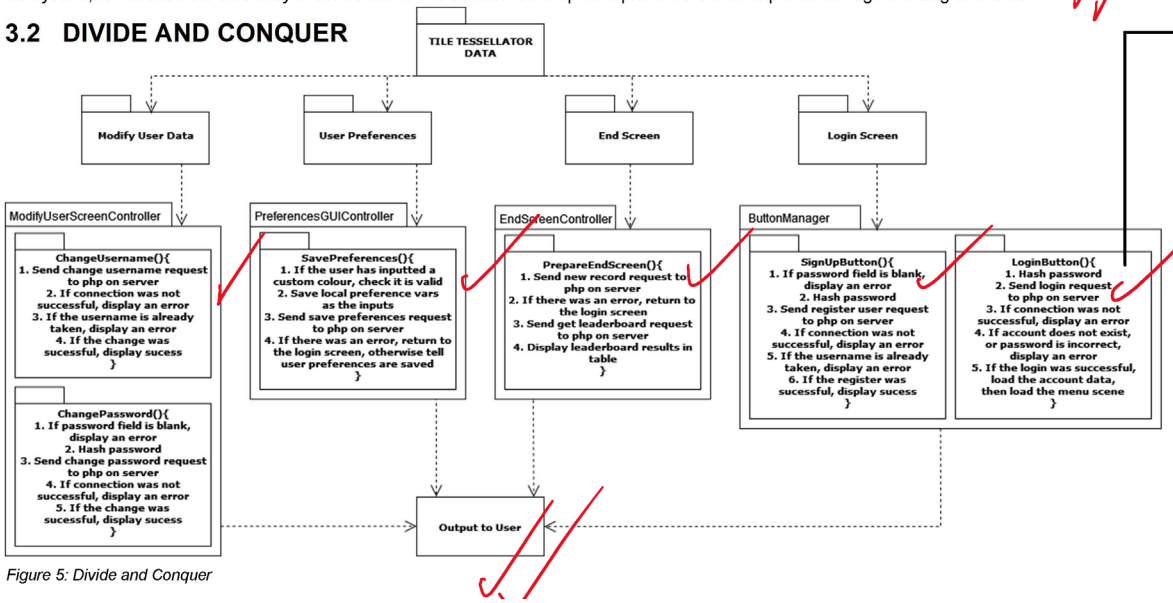


Figure 5: Divide and Conquer

```
FUNCTION LogIn()
    // Hash the password input
    CALCULATE hashedPassword = Hash(PasswordInput)

    DECLARE loginData = {UsernameInput, hashedPassword}

    // Send the post request to the database
    WAIT FOR WebRequestHandler.DBPost("Login", OUTPUT
        loginResponse, SerializeObjectToJSON(loginData))

    // Reload login screen if there is an error
    IF loginResponseSuccess = 3 THEN
        ReloadLoginPage()
        ASSIGN errorText = "Incorrect username or password"
    ELSE IF loginResponseSuccess ≠ 0 THEN
        ReloadLoginPage()
        ASSIGN errorText = "Internal error"
    END IF

    // Set variables based on values of user
    ASSIGN StoredUserID = loginResponseUserID
    ASSIGN  StoredUsername  =  UsernameInput
    ASSIGN StoredHashedPassword = hashedPassword
    ASSIGN StoredMovesRecord = loginResponseMovesRecord
    ASSIGN StoredTimeRecord = loginResponseTimeRecord
    IF loginResponseSensitivity ≠ null THEN
        StoredSensitivity = loginResponseSensitivity
    END IF
    IF loginResponseViewBobbing ≠ null THEN
        StoredViewBobbing = loginResponseViewBobbing
    END IF
    IF loginResponseInvertYAxis ≠ null THEN
        StoredInvertYAxis = loginResponseInvertYAxis
    END IF
    IF loginResponseTileColour ≠ null AND TryParseHexToColor(
        loginResponseTileColour, OUPUT tileColour) THEN
        StoredTileColour = tileColour
    END IF

    // Go to main menu
    LoadScene("Menu")
END FUNCTION
```

Figure 6: LogIn Function Pseudocode

Practices to strengthen

To further ensure accuracy and consistency of the application of the ISMG for this IA, it is recommended that:

- when matching evidence to the characteristics for the Analysing criterion, attention should be given to insightful analysis of the data exchange problem and relevant information related to data security to
  - identify the data structures and data exchange methods. High-level responses demonstrate effective use of the explore phase of the problem-solving process, e.g. recognising constraints, dissecting problems and existing solutions to similar problems, and using design, systems and computational thinking processes to make decisions
  - identify risks to data and code components. High-level responses consider risks to data confidentiality, integrity and availability to inform a security strategy for data. They explore existing solutions with similar elements, components or features (e.g. programming language, data interface, database engine) to consider the unique vulnerabilities of the data exchange system and/or explore emerging technologies (Syllabus section 1.1.1) relevant to the make-up of the data exchange system to investigate potential impacts or threats. Effective implementation of the explore phase of the problem-solving process to investigate and access information relevant to the problem creates opportunities for students to demonstrate high-level analysis, synthesis and decision-making about referencing conventions.
- when matching evidence to the characteristics for the Synthesising and evaluating criterion, attention should be given to the critical evaluation of impacts, considering that this is clearly demonstrated when responses first determine possible personal, social and economic impacts relevant to the real-world identified problem. The evaluation of impacts, components and low-fidelity prototypes is ensured when the evidence demonstrates that this is done against the prescribed and self-determined criteria in order to measure the overall success and suitability of the solution to make refinements and justified recommendations, e.g. annotations on user interface sketches or screenshots to justify decisions based on user testing and identified personal impacts.

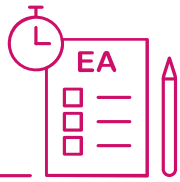
Additional advice

- Schools should ensure the video submission is of a sufficient file quality, especially for diagrams and audio, i.e. the scale of images or the output resolution of files should not render the details of the images or diagrams illegible, difficult to interpret or understand. Schools are responsible for ensuring the quality and accuracy of the required files before they are submitted to the QCAA. Each file must be complete and accessible for review by the QCAA (*QCE and QCIA policy and procedures handbook v5.0*, Section 9.7.1).
- Review the *Making judgments* webinar in the QCAA Portal. Digital Solutions uses a best-fit approach to apply an ISMG. Follow the three steps described in the webinar to ensure correct mark allocation.
- Schools should refer to Sections 7.4 and 9.6.6 of the *QCE and QCIA policy and procedures handbook v5.0* for information about when amendments and comparable assessment are required. The administration of an endorsed task with annotated changes to the task that has not been reviewed through the amendment process risks the validity, accessibility and reliability of the task and equity for students.
- Clearly and consistently apply school-based assessment policies and procedures for managing response length when making judgments about student responses to assessment.

Assessment responses that exceed syllabus length conditions must be accompanied by clear annotations to show how the school's assessment policy has been applied and which evidence was used to make a judgment. Further information about managing assessment response length is available the *QCE and QCIA policy and procedures handbook v5.0*, Section 8.2.6. Schools are responsible for ensuring that students are aware of the school-based assessment policy and procedures, particularly regarding management of response length.

- Schools are responsible for gathering evidence of student achievement in response to the endorsed assessment in the required mode of delivery (*QCE and QCIA policy and procedures handbook v5.0*, Section 8.2.7). IA3 requires a 1–2-minute video submission.

External assessment



External assessment (EA) is developed and marked by the QCAA. The external assessment for a subject is common to all schools and administered under the same conditions, at the same time, on the same day.

Examination (25%)

Assessment design

The assessment instrument was designed using the specifications, conditions and assessment objectives described in the summative external assessment section of the syllabus.
The examination consisted of one paper with 10 multiple choice questions (10 marks), four short response questions (34 marks) and one extended response question (25 marks).

The examination assessed subject matter from Unit 4. Questions were derived from the context of digital impacts.

The assessment required students to respond to multiple choice, short response and extended response questions, which explored varied subject matter from the unit.

The stimulus included a range of scenarios, diagrams and pseudocode.

Assessment decisions

Assessment decisions are made by markers by matching student responses to the external assessment marking guide (EAMG). The external assessment papers and the EAMG are published in the year after they are administered.

Multiple choice question responses

There were 10 multiple choice questions.

Percentage of student responses to each option

Note:

- The correct answer is **bold** and in a blue shaded table cell.
- Some students may not have responded to every question.

Question	A	B	C	D
1	14.9%	13.82%	**60.32%**	10.7%
2	**85.29%**	2.04%	1.4%	11.15%
3	17.01%	26.05%	**56.37%**	0.38%
4	7.58%	**88.15%**	3.44%	0.64%
5	**77.01%**	10%	4.71%	7.96%
6	11.08%	15.22%	**49.36%**	24.01%
7	22.93%	12.87%	12.17%	**51.85%**
8	24.65%	**56.18%**	5.48%	13.44%
9	14.39%	10.7%	9.87%	**64.9%**
10	4.39%	8.09%	**78.73%**	8.54%

Effective practices

Overall, students responded well to:

- multiple choice questions requiring an understanding of useability principles, network transmission principles, the characteristics of symmetrical and asymmetrical encryption methods and data structures
- aspects of short response questions that required knowledge retrieval and varying degrees of analysis to describe, symbolise, evaluate and justify relevant Unit 4 subject matter
- aspects of the extended response question through insightful analysis of stimulus and application of relevant subject matter knowledge to develop and evaluate solutions through symbolisation, explanation and justification.

Samples of effective practices

Short response

The following excerpts are from Question 11a. It required students to analyse information about a digital ticketing system to describe how data size and security can be managed to fulfil prescribed criteria.

Effective student responses:

- described valid methods for managing data size and security
- correctly described how data compression, encryption and hashing are used in the storage and transfer of data.

These excerpts have been included to demonstrate:

- valid variations in response to this question
- accurate knowledge utilisation of relevant subject matter to the problem.

Excerpt 1

Data size: Upon collection, data should be compressed, reducing its file size and keeping data size to a minimum. Furthermore, optimised storage methods, like using a modern data storage program (e.g. JSON), would help reduce storage taken up by system.

Data security: The requirement, 'data should be securedely transmitted', means that it should be encrypted after it is submitted by the user, then can be ~~decrypted~~ verified by the server upon recieval. ~~An RSA~~ A hashing algorithm could be used here as, ~~it's asymmetric process would ensure security.~~ the users password would be encrypted into a fixed-length string of random characters, the sever can check this string against the it's stored ~~pass~~ hashed password to verify it.

Excerpt 2

Data size: The data received should make use of a reversible compression ↑encryption algorithm before it is inserted into the database which would save space and simultaneously protect user data.

Data security: The web interface should use HTTPS, as asymmetric encryption in transit ~~to~~ will make it difficult for malicious third parties to access personal information that is submitted through the system.

The following excerpts are from Question 11b. It required students to complete an algorithm to secure the user password, verify the username and password and incorporate safety using pseudocode. There were many valid variations to this response, which were awarded marks for each descriptor, e.g. students may have used other methods to secure the password instead of hash.

Effective student responses:

- implemented safety in an unambiguous manner
- verified both the username and the password in an unambiguous manner.

These excerpts have been included to demonstrate:

- unambiguous use of algorithm constructs
- valid variations in response to this question
- accurate knowledge utilisation of relevant subject matter to the problem.

Excerpt 1

```
BEGIN
    INPUT username
    INPUT password
    SET encryptor() = ~~hashstr()~~ hashingAlgorithm()
    ~~SET~~
    encryptedPassword = encryptor(password)
    SELECT ~~p~~encryptedPass from database where user = 'username'
    IF encryptedPass == encryptedPassword:
        VERIFY user
        ~~CONTINUE~~ to site CONTINUE to site
    ELSE IF encryptedPass != encryptedPassword:
        RETURN 'Password incorrect, try again.'
        BREAK
    ELSE IF username not in database:
        RETURN '{username} does not exist'
        BREAK
    ELSE:
        RETURN 'error'
END
~~Usability Pri.~~
Useability Principle of Safety: Encrypts user data, ~~helps~~ notifies user of
errors, helps them recover from mistakes
```

Excerpt 2

```
BEGIN
      INPUT username
      INPUT password
      SET check = (SELECT username FROM users
                   WHERE username = username
   IF check IS NOT NULL THEN
   HASH SET salt = SELECT salt FROM users
                   WHERE username = username
      password = password + salt
      Hash (password)
      IF password =
   SET stored_pass = SELECT password FROM users
                     WHERE username = username
      IF password = stored_pass THEN
         RETURN 'success'
      ELSE
         RETURN 'Incorrect Password'
      ENDIF
   ELSE
     RETURN 'user not found'
   ENDIF
END
```

The following excerpt is from Question 12a. It required students to analyse information about a digital data exchange system to evaluate the security impacts to identify personal data security needs.

Effective student responses:

- demonstrated a clear understanding of personal versus social and economic needs concerning data security
- were contextualised to the problem.

These excerpts have been included to demonstrate:

- responses contextualised to the problem
- valid variations in response to this question
- effective knowledge utilisation of relevant subject matter to the problem.

Excerpt 1

The first security concern is that unauthorised personal could tample with personal data, ~~(e.g. parent changes~~ for example, a worker could falsify the dental records of a student, or change the pricing informati of a check-up. This could result in lessened or unnessary expenses for patients depending on the parties involved, and demonstrates the need for ~~encryption.~~ authorisation. ~~Sending encrypted records Encrypting records before storing them on the computer or sending them over email would~~ Only allowing relevant parties (e.g. the patients dentist), to access the ~~relevant~~ records would prevent malicious tampering and protect user privacy. The second concern is that information could be leaked and read by ~~malitious~~ malicious parties, either by email intercept or looking ~~on~~ through the computer, due to the lack of encryption. Personal data needs to be stored in a secure manner so user details (especially important info like credit card numbers or medibank details), are kept safe.

Excerpt 2

The lack of standard data security in transit or a secure login system exposes patients' personal information to untrusted parties, putting them at risk of identity theft or other malicious acts.

Through this, two personal data security needs can be deduced. Firstly, personal data should be expected to be transmitted safely in a way that it cannot be intercepted or altered. Secondly, it should be expected that only authorised people can access personal data, and that it should otherwise be inaccessible or unreadable.

The following excerpts are from Question 12b. It required students to describe the secure features of VPN within the context of the digital data exchange system and how this could improve data security.

Effective student responses:

- were contextualised to the problem.

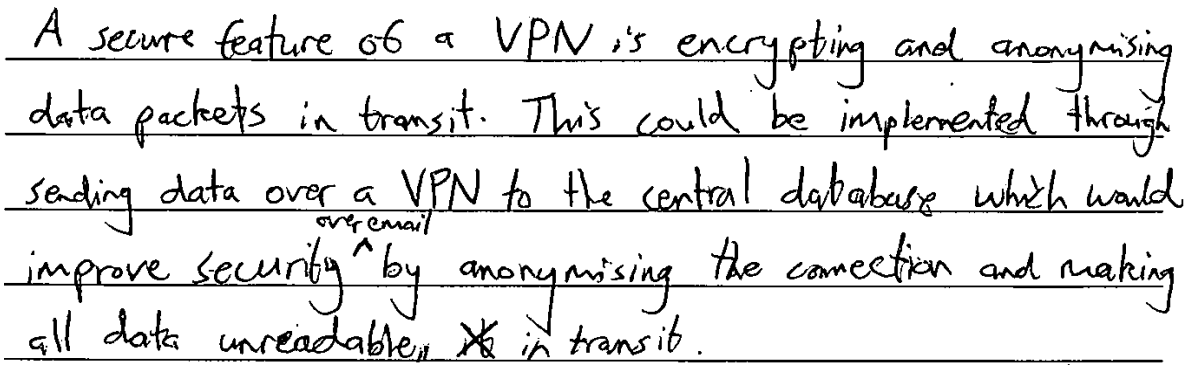
These excerpts have been included to demonstrate:

- valid variations in response to this question
- effective knowledge utilisation of relevant subject matter to the problem.

Excerpt 1

One of the features of a VPN that makes it secure is it's ability to mask user traffic data and IP addresses. Although this not directly stop workers from accessing personal info through the computer, hackers and other malicious third-parties would not be able to remotely intercept data transfers. For example, when emailing data through a ~~while using a~~ VPN the IP information and patient info would be masked and encrypted, and ~~thus can't be accessed~~ thus improving data security.

Excerpt 2



The following excerpt is from Question 13. It required students to analyse a one-time pad encryption algorithm and use pseudocode to correct errors and justify their responses.

Effective student responses:

- identified the errors and corresponding line numbers
- replaced or corrected the identified errors without adding any further changes to the algorithm
- were logically justified.

This excerpt has been included to demonstrate:

- a full-mark response
- effective knowledge utilisation of relevant subject matter to the problem.

Line 9 should be

FOR i = 0 to 7

as plainText is a 8 character word and the original line is used for a 10 character word.

Line 12 should be

IF plainText[i] = alphabet[j] THEN

as the j index has 26 characters and is used for the ~~op~~ alphabet, not the plainText. Additionally, the ~~if e~~ if statement was incomplete without the THEN.

Line 21 ~~so~~ should be

OUTPUT cipherText

as the original line would only ~~out~~ display one letter encrypted rather than the whole ciphertext.

Line 18 should be

~~cipherText[i] = alphabet[alphabetLocation+ key[i]~~

cipherText[i] = alphabet[(alphabetLocation + key[i]) mod 26]

as it was missing a square bracket to denote its identity as an index of alphabet.

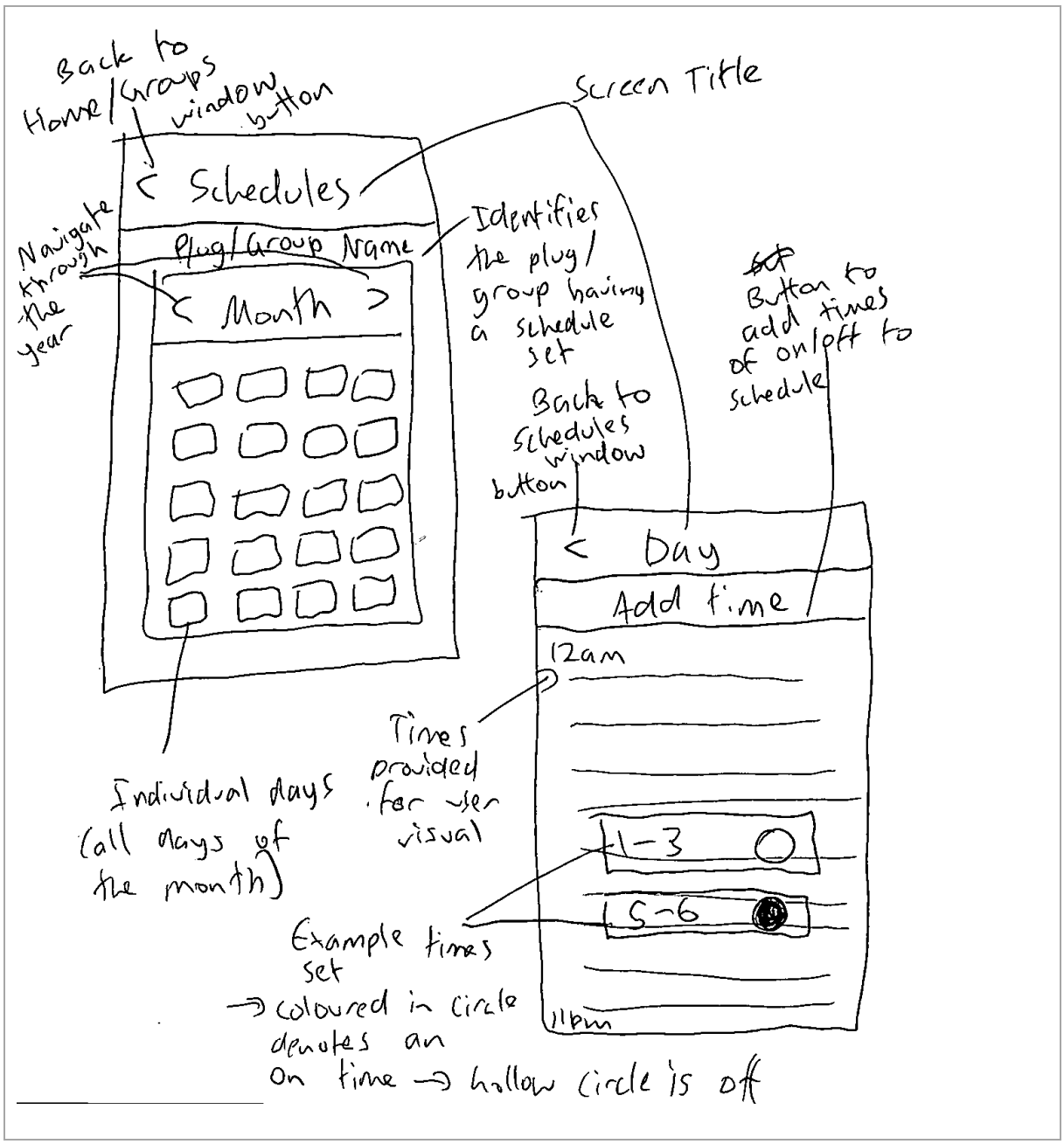
The following excerpt is from Question 14a. It required students to analyse a stimulus user interface to symbolise new screens for additional functional features.

Effective student responses:

- made explicit use of elements of visual communication in a similar style to the stimulus, e.g. shapes to symbolise all the necessary features, using annotations to communicate facts about visual elements, if necessary
- used extra pages, if necessary, to ensure the response demonstrated all required features
- were legible and able to be understood.

This excerpt has been included to demonstrate:

- a full-mark response.



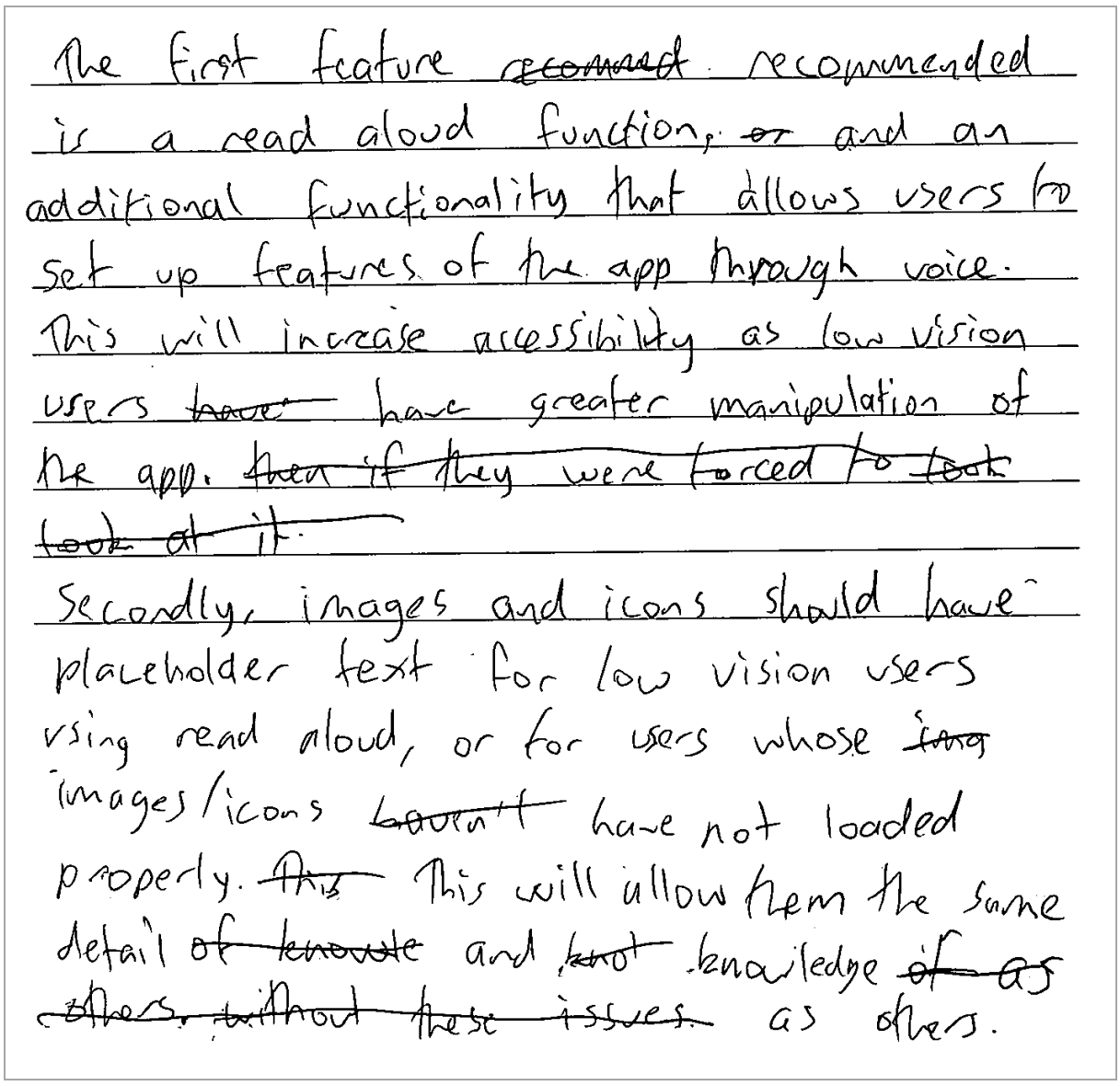
The following excerpt is from Question 14b. It required students to evaluate the stimulus user interface to make recommendations for improvement to accessibility with justification.

Effective student responses:

- demonstrated an understanding of the definition of accessibility, as it can be confused with other principles of useability
- were able to justify recommendations with examples relevant to specific accessibility needs and user interactions, e.g. the use of screen readers by visually impaired users or colour contrast ratios for colourblind users.

This excerpt has been included to demonstrate:

- a full-mark response.


The first feature ~~recomand~~ recommended is a read aloud function, ~~or~~ and an additional functionality that allows users to set up features of the app through voice. This will increase accessibility as low vision users ~~have~~ have greater manipulation of the app. ~~then if they were forced to look at it.~~

Secondly, images and icons should have placeholder text for low vision users using read aloud, or for users whose ~~imag~~ images/icons ~~haven't~~ have not loaded properly. ~~This~~ This will allow them the same detail ~~of knowle~~ and ~~knot~~ knowledge ~~of as others. without these issues.~~ as others.

Extended response

The following excerpts are from Question 15a. It required students to symbolise sample data in XML format. In Unit 4, students are expected to be able to explain the transfer of XML data and describe data using appropriate naming conventions, formats and structures. This question combines this subject matter.

Effective student responses:

- demonstrated relevant subject matter knowledge about the features of XML for the transfer of data across networked systems
- recognised that XML consists of parent and child elements.

These excerpts have been included to demonstrate:

- full-mark responses
- valid variations in response to this question.

Excerpt 1

<Candidate>
<Name> Candidate X </Name>
<Year> 11 </Year>
<Nomination> Esports Captain </Nomination>
</Candidate>

Excerpt 2

<Candidate>
<Position> Esports </position>
<year> 11 </year>
<name> X </name>
<nominations> 0 </nominations>
</candidate>

Extended response

The following excerpt is from Question 15b. It required students to analyse information about a voting system to explain how particular system features would ensure the implementation of three voting rules.

Effective student responses:

- included variations of
  - user authentication
  - validation of votes
  - limited access based on the voting period.

These excerpts have been included to demonstrate:

- full-mark responses
- valid variations in response to this question.

Excerpt 1

To ensure only students and staff can vote, and not an admin user, a column for 'userType' should exist in the user table. When casting a vote, a request will then need to be made to the server to verify that they have 'student' or 'staff' in this column - the vote should not be made if this condition is not satisfied. Presumably, votes will be made to a vote table, where the user's ID will be referenced in an entry to know who the vote was for and who they voted for. The database will need to be queried and iterated through when a user votes to check whether a user has already voted for a specific role (like esports captain) already. If this check fails, then the vote should not be stored. This can also be inforced with SQL unique constraints when making the table. When voting, the time of vote will need to be sent in the request made to the server. This date and time will be compared to the 8:30 am - 4:00 pm requirement defined in the backend for a specific date. Should the time and date not correlate with the definition, the vote should not be stored in the database.

Excerpt 2

To ensure that only staff can vote, all registered voting emails must be validated through some form of authentication. ~~The possible methods include having admin staff verify a~~ A possible system feature for this is only allowing particular email addresses to submit a vote (~~those~~ emails that the voting application was sent to), by comparing log-ins to an email list. A database could be used to ensure that each user only votes once. For example, create a database listing all validated emails or usernames, and add a 'flag' column indicating whether a vote has been submitted from that user. When an application is submitted, the system should check the 'flag', if no application had previously been submitted, accept the submission and update the relevant data, if an application was previously submitted, reject the current one. Finally, the ~~vot~~ time condition can be upheld by only accepting applications sent during the two times. A time stamp could be attached to each submission, and upon recieval, this would be ~~verified~~ to checked to determine whether the vote is valid. Alternatively, all voting systems could be closed at 4pm.

Extended response

The following excerpts are from Question 15c. It required students to develop a data flow diagram to symbolise a programmed component that enforces the three voting rules for the voting system and integrates the school's existing database.

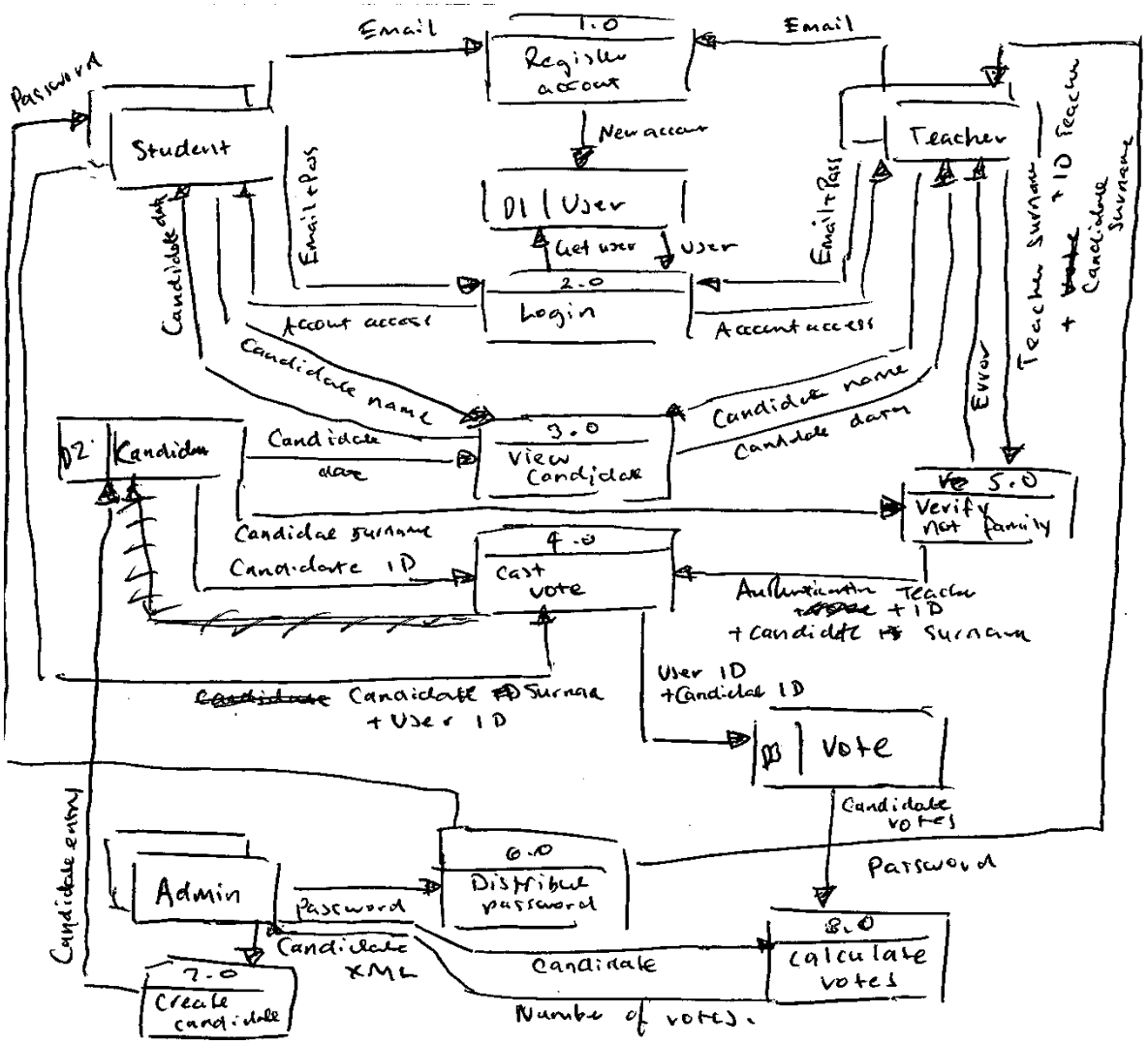
Effective student responses:

- used the syllabus conventions for data flow diagrams
- included all the necessary entities, processes, data stores and data flows
- labelled elements logically and appropriately with verbs and nouns where appropriate.

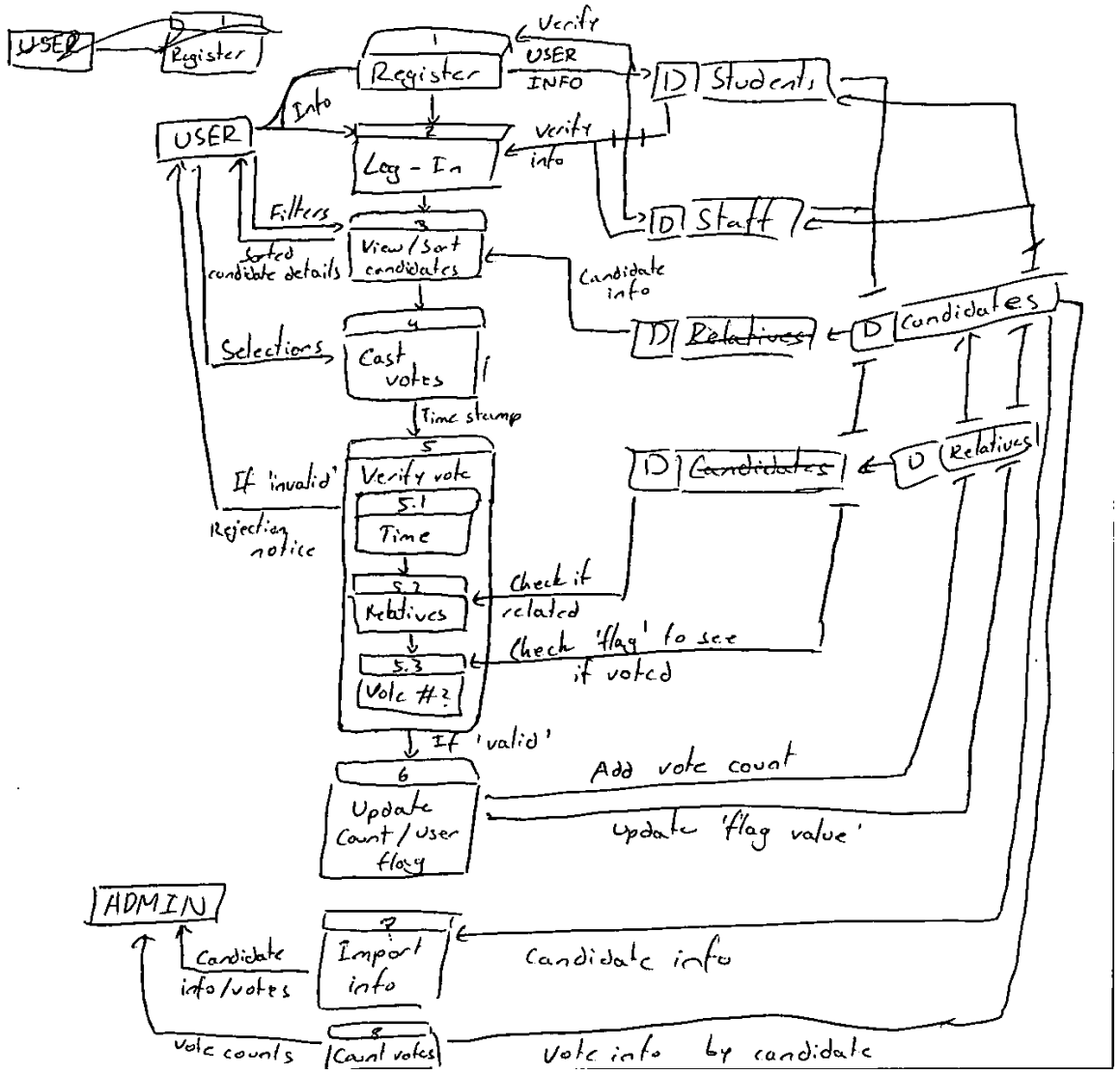
These excerpts have been included to demonstrate:

- full-mark responses
- valid variations in response to this question.

Excerpt 1


Email
1.0
Register account
Email
Password
Student
Teacher
New account
D1 User
Get user
User
Email + Pass
2.0
Login
Account access
Account access
Candidate data
Candidate name
3.0
View Candidate
Candidate name
Candidate data
D2 Kandidat
Candidate data
Candidate surname
Candidate ID
4.0
Cast vote
Authentication
+ ID
+ Candidate Surname
5.0
Verify not family
Error
Teacher Surname
+ ID
Candidate Surname
+
User ID
+ Candidate ID
D3 Vote
Candidate votes
Password
Candidate entry
Admin
Password
6.0
Distribute password
Candidate XML
Candidate
8.0
Calculate votes
Number of votes
7.0
Create candidate

Excerpt 2



The following excerpts are from Question 15d. It required students to justify their response to Question 15c by explaining the symbolised DFD elements and their relationships to each other.

Effective student responses:

- explained the relationship between all symbolised processes, data stores and external entities
- recognised the difference between ‘describe’ and ‘explain’, providing more depth of information and the purpose of elements
- did not repeat or restate information already communicated by the response to 15c.

These excerpts have been included to demonstrate:

- full-mark responses
- valid variations in response to this question
- effective knowledge utilisation of relevant subject matter to the problem.

Excerpt 1

In order to create the DFD, the school's previous database had to be expanded by creating a 'Vote' table and 'Candidate' table. Candidates have already been defined in XML by admins, which alone is incompatible in a database. A process was created to import XML and produce an entry that can be implemented in the candidate table. The 'vote' table stores a USERID, the ID of the candidate they are voting for as well as a nomination category. Voting has multiple restrictions in place to ensure desired data flow. A process exists to compare the surname of a teacher to that of the candidate they are voting for. If they match, an error is displayed to the teacher and the vote does not count to prevent a conflict of interest. Additionally, checks are also made in the 'cast vote' process to ensure other restrictions, such as that the time to vote is viable and a user has not already voted for a category. No data flow exists between this process and an admin since they do not have voting permissions. Additionally, admins manually input a key to a process that then distributes said password to registered students and staff when voting commences. This prevents anyone from voting before the voting period. Users must first register before they are given access to vote, considering it is mandatory that the vote table tracks the ID of the current user, which is only generated for registered users.

Excerpt 2

Assuming the schools database is normalised, it is likely split the relevant information can likely be split into three parts: students, staff and relatives. Since both students and staff perform and see the same process they were referred to as 'user'. The verif email verification (preventing random people from voting), is shown with the 'verify' relationship between process 1 and the student and staff databases. Logging-in uses data from these two databases to verify identities, thus the 'verify' connector was used. The arrows between process symbolise info being sent between pages (e.g. you can't access the vote views without first logging in). The exception to this is the 'time stamp' between processes 4 & 5, since this info is taken from the system. Process 3 is viewing and sorting user votes, fulfilling the criteria for 'a list of candidates ordered by nominated leader positions'. User interact with this process (filter selection), to get the data they want. Users should then cast their votes after selecting candidates, fulfilling the general purpose of the application. All verification functions were put into one process as user inputs are typically verified AFTER they are submitted to the system. This process then verifies (checks the systems three voting roles. The 'voting #' section represents checking the users 'flag', which is why it is connected to the staff/student data frames (where the 'flag' should be stored). After verification is complete the vote counts are updated.

Practices to strengthen

When preparing students for external assessment, it is recommended that teachers:

- revise the data flow diagram conventions with students for the symbolisation of the data flow of digital systems. Some student responses demonstrated a combination of flow charts and similar diagrams. Others did not label processes and flow arrows with verbs and nouns to effectively communicate the purpose and interrelationships between elements
- provide opportunities for students to practise knowledge utilisation of algorithm logic and constructs and use of pseudocode to solve programming problems.

Additional advice

- It is recommended that students practise diagrammatic responses and are made aware that if a question requires them to symbolise visual elements
  - the explicit use of this cognition indicates that if something is not symbolised, this may affect the number of marks that can be awarded
  - the use of annotations or comments would be used to describe visual elements, but alone they may not contribute to the response as they are considered written features and would not match to the EAMG descriptor for ‘symbolising’.
- It is recommended that students pay close attention to response requirements, e.g. if three specific items are to be addressed, students should address each requirement in a clear and systematic way.
- It is recommended that students develop a general repertoire of personal, social and economic impacts to arm them with sufficient knowledge to facilitate practical analysis of stimulus to make recommendations and determine needs.
- It is recommended that students not cancel out or cross out responses to questions if they do not follow with another attempt, as this will result in an ‘NA’ for that question.