Investigation — technical proposal (20%)

This sample has been compiled by the QCAA to assist and support teachers to match evidence in student responses to the characteristics described in the instrument-specific marking guide (ISMG).

Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. recognise and describe data sources, programming elements, user interface components and useability principles
2. symbolise algorithms and user interfaces, and explain ideas and interrelationships between proposed data structures and user experiences of the identified problem
3. analyse the problem and information related to the selected technology context
4. determine programming and user experience requirements of the identified problem and prescribed and self-determined criteria
5. synthesise information and ideas to determine possible data elements, user interface and algorithm components for digital solutions
6. generate a technical proposal for user interfaces and algorithm components of the low-fidelity prototype digital solution
7. evaluate impacts, components and a low-fidelity prototype against prescribed and self-determined criteria to make refinements and justified recommendations
8. make decisions about and use mode-appropriate features, language and conventions for written and spoken communication for a technical audience.
Instrument-specific marking guide (ISMG)

Criterion: Retrieving and comprehending

Assessment objectives

1. recognise and describe data sources, programming elements, user-interface components and useability principles

2. symbolise algorithms and user interfaces, and explain ideas and interrelationships between proposed data structures and user experiences of the identified problem

<table>
<thead>
<tr>
<th>The student work has the following characteristics:</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• accurate and discriminating recognition and discerning description of data sources, programming elements, user-interface components and useability principles</td>
<td>4–5</td>
</tr>
<tr>
<td>• adept symbolisation of algorithms and user interfaces and discerning explanation of ideas and interrelationships between proposed data structures and user experiences of the identified problem.</td>
<td></td>
</tr>
<tr>
<td>• makes statements about elements and features of data, programming, user interface or useability principles</td>
<td>2–3</td>
</tr>
<tr>
<td>• variable symbolisation of algorithms and superficial explanation of aspects of ideas or interrelationships related to the identified problem.</td>
<td></td>
</tr>
<tr>
<td>• does not satisfy any of the descriptors above.</td>
<td>1</td>
</tr>
</tbody>
</table>

1
Criterion: Analysing

Assessment objectives

3. analyse the problem and information related to the selected technology context
4. determine programming and user-experience requirements of the identified problem and prescribed and self-determined criteria

<table>
<thead>
<tr>
<th>The student work has the following characteristics:</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• insightful analysis of the problem and relevant contextual information to identify the relevant elements and features of user interface, data and programming components and their relationships to the structure of the identified problem.</td>
<td>5–6</td>
</tr>
<tr>
<td>• astute determination of programming and user-experience requirements of the identified problem and essential prescribed and self-determined criteria.</td>
<td></td>
</tr>
<tr>
<td>• appropriate analysis of the problem and contextual information to identify some elements and features of user interface, data and programming components and their relationships to the structure of the identified problem.</td>
<td>3–4</td>
</tr>
<tr>
<td>• reasonable determination of programming and user-experience requirements of the identified problem and some prescribed and self-determined criteria.</td>
<td></td>
</tr>
<tr>
<td>• superficial analysis of the problem or aspects of information to identify some elements or features of user interface or data or programming components or their relationships to the structure of the identified problem.</td>
<td>1–2</td>
</tr>
<tr>
<td>• vague determination of some programming or user-experience requirements of the identified problem or prescribed criteria.</td>
<td></td>
</tr>
<tr>
<td>• does not satisfy any of the descriptors above.</td>
<td>0</td>
</tr>
</tbody>
</table>
**Criterion: Synthesising and evaluating**

**Assessment objectives**

5. synthesise information and ideas to determine possible data elements, user interface and algorithm components for digital solutions

6. generate a technical proposal for user interfaces and algorithm components of the low-fidelity non-coded prototype digital solution

7. evaluate impacts, components and a low-fidelity prototype against prescribed and self-determined criteria to make refinements and justified recommendations

<table>
<thead>
<tr>
<th>The student work has the following characteristics:</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• coherent and logical synthesis of relevant information and ideas to determine data elements, user interface and algorithm components for digital solutions</td>
<td>5-6</td>
</tr>
<tr>
<td>• purposeful generation of a technical proposal for relevant user interfaces and algorithm components of the low-fidelity non-coded prototype digital solution</td>
<td></td>
</tr>
<tr>
<td>• critical evaluation of impacts, components and low-fidelity prototypes against effective prescribed and self-determined criteria to make refinements and astute recommendations justified by data.</td>
<td></td>
</tr>
<tr>
<td>• simple synthesis of information and ideas to determine possible data elements, user interface and algorithm components for digital solutions</td>
<td>3-4</td>
</tr>
<tr>
<td>• adequate generation of a technical proposal for some user interfaces and algorithm components of the low-fidelity non-coded prototype digital solution</td>
<td></td>
</tr>
<tr>
<td>• feasible evaluation of impacts, components and low-fidelity prototypes against some prescribed and self-determined criteria to make refinements and fundamental recommendations justified by data.</td>
<td></td>
</tr>
<tr>
<td>• rudimentary synthesis of information or ideas to determine possible data elements, user interface and algorithm components for digital solutions</td>
<td>1-2</td>
</tr>
<tr>
<td>• generation of elements of the low-fidelity non-coded prototype digital solution</td>
<td></td>
</tr>
<tr>
<td>• superficial evaluation of impacts, components or low-fidelity prototype against criteria.</td>
<td></td>
</tr>
<tr>
<td>• does not satisfy any of the descriptors above.</td>
<td>0</td>
</tr>
</tbody>
</table>
Criterion: Communicating

Assessment objectives

8. make decisions about and use mode-appropriate features, language and conventions for written and spoken communication for a technical audience

<table>
<thead>
<tr>
<th>The student work has the following characteristics:</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• discerning decision-making about, and fluent use of</td>
<td>2–3</td>
</tr>
<tr>
<td>– written, visual and/or spoken features to communicate about a solution</td>
<td></td>
</tr>
<tr>
<td>– language for a technical audience</td>
<td></td>
</tr>
<tr>
<td>– grammatically accurate language structures</td>
<td></td>
</tr>
<tr>
<td>– referencing and investigation conventions.</td>
<td></td>
</tr>
<tr>
<td>• variable decision-making about, and inconsistent use of</td>
<td>1</td>
</tr>
<tr>
<td>– written, visual and/or spoken features</td>
<td></td>
</tr>
<tr>
<td>– suitable language</td>
<td></td>
</tr>
<tr>
<td>– grammar and language structures</td>
<td></td>
</tr>
<tr>
<td>– referencing or investigation conventions.</td>
<td></td>
</tr>
<tr>
<td>• does not satisfy any of the descriptors above.</td>
<td>0</td>
</tr>
</tbody>
</table>
Context

The Australian Computer Society (ACS) and the Open Data Institute of Queensland each year invite high school students to present a technical proposal at the Digital Disruptors pre-Awards dinner. These technical proposals are always for a new innovative digital solution that solves a real-world problem and/or benefits Queenslanders. The attendees at the dinner will be ACS members.

Task

Prepare a technical proposal for the Digital Disruptors pre-Awards dinner for a new innovative digital solution that uses open government data. You will analyse two relevant datasets from the Queensland open data portal (www.data.qld.gov.au) and select one to be used in your technical proposal. You will then present a multimodal presentation of the technical proposal to your teacher using communication appropriate for a technical audience.

Sample response

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Marks allocated</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retrieving and comprehending Assessment objectives 1 and 2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Analysing Assessment objectives 3 and 4</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Synthesising and evaluating Assessment objectives 5, 6 and 7</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Communicating Assessment objective 8</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>
The annotations show the match to the instrument-specific marking guide (ISMG) performance-level descriptors.

The following images and the text are a partial transcript of the visual and spoken components of the students’ audio-visual response.

The video can be viewed at https://www.qcaa.qld.edu.au/downloads/portal/media/snr_digital_solutions_19_ia1_high_res.mp4

**Slide 3**

The task requirements fall into eight parts. These include an evaluation, identification of algorithmic components, success criteria, user experience and data requirements. Datasets are chosen from the Queensland data website.

**Slide 5**

### Criteria

<table>
<thead>
<tr>
<th>Prescribed criteria</th>
<th>Self-determined criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• personal, social and economic impacts and considerations to identify risks</td>
<td>• accuracy of data</td>
</tr>
<tr>
<td>• accuracy and efficiency of the algorithms</td>
<td>• data can be uploaded to the database from a .csv file</td>
</tr>
<tr>
<td>• present a user-interface prototype</td>
<td>• ease of use for target audience</td>
</tr>
<tr>
<td>• present a low-fidelity non-coded prototype digital solution</td>
<td></td>
</tr>
</tbody>
</table>

These success criteria have been set.
Retrieving and comprehending [4–5]
Accurate and discriminating recognition and discerning description of data sources, programming elements, user-interface components and usability principles.

Analysing [5–6]
Insightful analysis of the problem and relevant contextual information to identify the relevant elements and features of user interface, data and programming components and their relationships to the structure of the identified problem.

Slide 9

Senior Saver is a new web application that aims to be a handy reference guide to Government concessions and discounts available to Queensland seniors.

Senior Saver uses the Government concessions and rebates for seniors dataset available from the Queensland Department of Communities, Disability Services and Seniors via the Queensland Government data website. The web application will be data-driven and created in HTML. CSS will be used for the presentation and PHP will be used to retrieve and display the data, which will be stored in a MySQL or MariaDB database.

Slide 10

Existing solutions

The Queensland Department of Communities, Disability Services and Seniors website has a facility for people to search for discounts available to seniors and carers. The ability to search for location is a good feature, however, the information about discounts is accessed via a drop-down menu containing a long list of categories and sub-categories, making information difficult to find. Many seniors would give up rather than trawl through these lists.

In contrast, the Senior Saver web application will have 11 categories. Categories will be displayed onscreen and for tablet users — all category icons will be visible without the need to scroll. The reduced list of categories will make it easier to find available concessions and discounts.
Synthesising and evaluating [5–6]
Critical evaluation of impacts, components and low-fidelity prototypes against effective prescribed and self-determined criteria to make recommendations justified by data.

Communicating [2–3]
Discerning decision-making about, and fluent use of written, visual and/or spoken features to communicate about a solution, language for a technical audience, grammatically accurate language structures and referencing and investigation conventions.

Slide 11

Existing solutions
Queensland Government’s “Information for Queenslanders”


“Be connected”

The Queensland Government’s ‘Information for Queenslanders’ web page uses accessibility features proposed for the Senior Saver interface. It uses large buttons with small, simple icons. Aimed at all Australians, the “Be Connected” website uses interface accessibility features that could be incorporated into Senior Saver. It uses easy to read buttons, high colour and contrast, and an accessibility feature that allows text to be resized on the web page. This is an essential feature of Senior Saver as visibility is an important aspect to consider when developing a web application for elderly people. Both web pages feature a white background for clear visibility of all page features.

Slide 13

Queensland Government data portal

Dataset 1
Business discount directory for senior and carer cardholders dataset


Dataset 2
Government concessions and rebates for seniors dataset


In developing the concept for Senior Saver, two datasets from the Queensland data portal were analysed. The Business discount directory for senior and carer cardholders dataset and the Government concession and rebates for seniors dataset. This dataset was chosen as the most suitable.
Retrieving and comprehending [4–5]
Accurate and discriminating recognition and discerning description of data sources, programming elements, user-interface components and usability principles.

Analysing [5–6]
Insightful analysis of the problem and relevant contextual information to identify the relevant elements and features of user interface, data and programming components and their relationships to the structure of the identified problem.

Both datasets are in XLSX Microsoft Excel format. This is ideal for the database, as data can be easily manipulated and saved as a CSV file for importing into the database. Although not updated frequently, both datasets are active. Both use a Creative Commons Attribution 4.0 licence, which allows the data to be copied and distributed in any medium or format and be remixed and transformed (Creative Commons, 2017). None of the data appears to be encrypted, however, it’s not the type of data that needs to be secured.

The ‘Business discount directory’ contains 7800 entries and focuses on providing contact details for businesses that provide discounts for one particular seniors card. Here there are also other datasets relating to companion card venues and a ‘Regional business discount directory’.
Analysing [5–6]

Insightful analysis of the problem and relevant contextual information to identify the relevant elements and features of user interface, data, and programming components and their relationships to the structure of the identified problem.

Slide 16

Dataset 1

Business discount directory for senior and carer cardholders

The advantage of the ‘Business discount directory’ dataset is that the Excel file is set out well for a database, with one piece of data in each column.

Slide 17

Dataset 2

Government concessions and rebates for seniors

The Government concessions and rebates for seniors spreadsheet is a much smaller dataset with fewer attributes and only 48 rows of data.
Analysing [5–6]
Insightful analysis of the problem and relevant contextual information to identify the relevant elements and features of user interface, data, and programming components and their relationship to the structure of the identified problem.

Synthesising and evaluating [5–6]
Coherent and logical synthesis of relevant information and ideas to determine data elements, user interface and algorithm components for digital solutions.

Purposeful generation of a technical proposal for relevant user interfaces and algorithm components of the low-fidelity non-coded prototype digital solution.

Slide 18

Dataset 2
Government concessions and rebates for seniors dataset


However, this spreadsheet is not as well organised, with the ‘Eligibility card type’ and ‘Alternate terms’ columns containing multiple data entries. Multiple entries in a list will need to be split up in the database. However, the data itself will be more useful for the new application.

Slide 19

Data dictionary
Organising the data from the dataset into the database

<table>
<thead>
<tr>
<th>Table: discounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Name</td>
</tr>
<tr>
<td>discountID</td>
</tr>
<tr>
<td>discount</td>
</tr>
<tr>
<td>link</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table: categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Name</td>
</tr>
<tr>
<td>discountID</td>
</tr>
<tr>
<td>category</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table: eligible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Name</td>
</tr>
<tr>
<td>discountID</td>
</tr>
<tr>
<td>eligibility</td>
</tr>
</tbody>
</table>

The dataset will be split up into three tables in the accompanying database for the Senior Saver web application. A discountID field will be added to represent the discount.

The first database table will be called ‘Discounts’ and consist of four fields: discountID, discount description, and link, with discountID as the primary key.

The second table will be called ‘Categories’ and consist of two fields: discountID and category, with both set as the primary key.

To improve usability, the category field will be based on the item field from the dataset. This will simplify the interface by having fewer categories for users to choose. The existing item names will be reorganised into categories and a discount will be able to apply to more than one category.

The third table will be called ‘Eligible’ and consist of two fields: discountID and eligibility, with both set as the primary key.
Retrieving and comprehending [4–5]
Accurate and discriminating recognition and discerning description of data sources, programming elements, user interface components and useability principles.

Slide 20

Sample data table: categories

This is an illustration of sample data that will be populated into the ‘Discounts’ table containing ID, discount name, description and link fields.

Slide 21

Sample data table: eligible

Sample data for the ‘Categories’ and ‘Eligible’ tables is illustrated here. The data will be taken from the dataset and split into different worksheets for exporting into a MySQL or MariaDB database.
Analysing [5–6]

Astute determination of programming and user-experience requirements of the identified problem and essential prescribed and self-determined criteria.

Analysing [5–6]

Insightful analysis of the problem and relevant contextual information to identify the relevant elements and features of user interface, data and programming components and their relationships to the structure of the identified problem.

Data source

Data will be taken from:
the Government concessions and rebates for seniors dataset

Available from:

Data for the Senior Saver database will only be taken from the Government concessions and rebates for seniors spreadsheet.

User interface

HOME page

This is the proposed design of the user interface for the HOME page of the Senior Saver web application. There is a standard search icon and facility in the top right corner and two buttons towards the bottom of the page. ‘Choose a service’ will go to a wireframe of all 11 categories of concessions and discounts from which the user can select a category.

‘What can I do with my card?’ will go to another page that will display icons of the various cards available. The web application will aid user experience by featuring the familiar search icon in the usual place. The interface will be optimised for an iPad, which was cited by National Seniors Australia in 2017 as the most popular device choice for seniors.
Retrieving and comprehending [4–5]
Accurate and discriminating recognition and discerning description of data sources, programming elements, user-interface components and usability principles.

Adept symbolisation of algorithms and user interfaces and discerning explanation of ideas and interrelationships between proposed data structures and user experiences of the identified problem.

Synthesising and evaluating [5–6]
Coherent and logical synthesis of relevant information and ideas to determine data elements, user interface and algorithm components for digital solutions.

Slide 25

This is an example wireframe of the page showing all categories. Each category features a button displaying a simple icon and text for the category. When the user clicks a category, their selection will be stored and entered in an SQL query, which will be run to obtain data for the next page.

Slide 26

This is a wireframe of the PHP page that will be displayed after a category has been selected. The page length will adapt to the various number of items that will appear dependent on the user’s choice. If a user selects the ‘What can I do with my card?’ option, this will lead to a similar screen populated with buttons containing text and an icon — one for each type of card available to a senior. Selecting a card will take you to a similar screen to this one but with card information rather than discount options.
Retrieving and comprehending [4–5]
Accurate and discriminating recognition and discerning description of data sources, programming elements, user-interface components and usability principles.

Adept symbolisation of algorithms and user interfaces and discerning explanation of ideas and interrelationships between proposed data structures and user experiences of the identified problem.

Slide 27

This illustrates the cards page, which shows all available concession cards, along with clickable links to the next page.

Slide 28

This is a PHP page generated from the card selected on the previous page. The heading and text will be inserted from the previous selection the user made. The rest of the page will be generated from a query that obtains relevant data from the database.
Attention to the user experience is vital for success. Useability is defined in terms of effectiveness, accessibility and safety. An effective website would enable a user to accurately and easily complete a task. Senior Saver makes finding information easier by minimising the number of clicks required to find information on discounts. Text will be kept to a minimum on pages so users can easily comprehend the information.

The HOME page will be very simple and contain one title, one image and two clickable category buttons. The category buttons will be large and clearly visible in high contrast to the background. Each button will feature minimal text and a simple icon.

Senior Saver has been designed for accessibility by people with visual and motor impairment. Links will feature large clickable areas and stand out on the page, so elderly users can more effectively navigate the site with easily recognisable buttons that require less precision for activation. High contrast colours will be used throughout the website. A white background will be used throughout with headings and body text in black. For readability, Sans Serif typeface will be used with at least 12-point font size for body text. Text on the ‘results’ page (i.e., the page after a user selects and clicks on a category) will be resizable, making the text easy to adjust for readability.

Users of the Senior Saver web application may access the site using a screen reader. To enable a better experience with a screen reader, the Lang attribute will be used to set the code to ‘en’ for English and alternative text will be used with all images.

The safety of the website has been considered as the user will not become lost in the website. A user will always be able to return to the previous page and there won’t be any flashing components or unnecessary distractions.
The algorithm for `discountResults.php` and `cardResults.php` are both very similar. In both cases, a value will be obtained from the previous page and passed through to this page using the POST method. Each will need to connect to the webserver and select the senior’s database. If the connection fails or the database is not found, an error message will be displayed. The data that has been posted from the previous page will be obtained and stored in a variable. If there is a value in the variable, a new variable will be assigned its contents. A query will be formed and stored in the variable `SQL`. The query will be run and the resulting data assigned to the variable called `result`. If the number of rows in `result` is greater than zero, while there is data in the variable it will be added to an array. The data in the array will then be displayed on the page. The contents of each page will be populated from the data received from the database.
Synthesising and evaluating [5–6]
Critical evaluation of impacts, components, and low-fidelity prototypes against effective, prescribed and self-determined criteria to make refinements and astute recommendations justified by data

**Slide 34**

<table>
<thead>
<tr>
<th><strong>PRESCRIBED CRITERIA</strong></th>
<th><strong>EVALUATION</strong></th>
<th><strong>RECOMMENDATIONS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal, social and economic impacts and considerations to identify risks</td>
<td>• Web app will be useful for seniors; many opportunities for them to save money; they need awareness and access knowledge; • Senior Savers does not collect or store any personal data; all data used is publicly available, so no cost to acquire the data; • Users not required to sign up or log into application; no facility to seek feedback in the application; • Minimal costs in manipulating the data and in-site maintenance.</td>
<td>• Some links in the dataset go to general pages, they don’t always go directly to the required information; check the pages and perhaps alter the links so the user is taken directly to the area within the website that they need; • Incorporate a feedback option to allow users to provide feedback to enhance the application.</td>
</tr>
</tbody>
</table>

User interface prototype

- **HOME** page is clear and easy to follow as only essential items are on the page; ability to resize text within the body of the page has not been incorporated into the pages that yield results; • button placement on the HOME page is very low on the page, to work with image.

- More thought needs to be given to the colour scheme and accessibility features; there is a lack of colour; consider changing the icons to be used, to incorporate some colour and line thickness of the text harmony with “—” symbols.
- Consider using a number of images of the HOME page so that it remains fresh looking; need to carefully choose images and match layout with image selection; move image up a little on the page.

Accuracy and efficiency of the algorithms

- Dataset has been manipulated into three database tables with no issues in assigning the dataset to the database tables; algorithm has been run on an existing dataset and it successfully reads and writes data into an array and displays data on a web page.

- Change Concession Cards page layout as is a large list.

Low-fidelity non-coded prototype digital solution

- Prototype works well; pages are easy to navigate; purple coloured buttons on the reservations page maybe too contrasting; there may be the need for use of colour throughout.

**Slide 35**

<table>
<thead>
<tr>
<th><strong>SELF-DETERMINED CRITERIA</strong></th>
<th><strong>EVALUATION</strong></th>
<th><strong>RECOMMENDATIONS</strong></th>
</tr>
</thead>
</table>
| Accuracy of data | • Accuracy of the data is dependent on an external source: Queensland Government’s Data Portal, last updated on 22/9/2017, i.e. 12 months ago, it is feasible that the data does not change frequently; • Data obtained from the source needs to be manipulated into tables for the database; categories used have been based on the “Alternate terms” in the original data; it is a reduced list determined by the developer and manually assigned to each discount; potential for inaccurate data at this point. | • Develop an automated assignment of categories based on the existing items, e.g. all discounts with the Alternate terms Leisure, Museums, Exhibitions and Entertainment will be assigned to the “Entertainment” category; all discounts with the Alternate terms Training, Education, Learning, Qualification, will be assigned to the category “Education”;
- This could be programmatically done and included in an administration side of the application enabling more accurate and faster data collection; if an administration side is added, a login screen will need to be incorporated; this could be on a separate web page and need not be visible to users. |

- The data can be uploaded to the database from a .csv file

- Dataset is available in both Excel and .CSV format from the Queensland Government’s Data portal.

- Dataset must be manipulated before uploading to the database; a recommendation would be to write code that will automate this.

| Ease of use for target audience | • Target audience has been kept in mind throughout the development process; minimal amount of text on the page, buttons are large and easy to read; • Sans serif font has been used throughout to aid readability. | • Concession Card and categories pages may benefit from being more similar looking; each currently contain quite a number of buttons; may be better to keep them in the same pattern as the service / category page layout. |

I have evaluated the project against the prescribed criteria. Evaluation and recommendations are described in the slide.

This slide presents the evaluation against self-determined criteria.
Communicating [2–3]
Discerning decision-making about, and fluent use of written, visual and/or spoken features to communicate about a solution, language for a technical audience, grammatically accurate language structures and referencing and investigation conventions.

Slide 37

Acknowledgements


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Thank you for your attention during my presentation.