



Queensland Curriculum and Assessment Authority

# Digital Solutions 2019 v1.2

IA2: Sample assessment instrument

## Project — digital solution (30%)

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

**Student name**

**Student number**

**Teacher**

**Issued**

**Due date**

## Marking summary

Criterion	Marks allocated	Provisional marks
Retrieving and comprehending	8	
Analysing	8	
Synthesising and evaluating	10	
Communicating	4	
<b>Overall</b>	<b>30</b>	

# Conditions

<b>Technique</b>	Project — digital solution
<b>Unit</b>	Unit 3: Digital innovation
<b>Topic/s</b>	Topic 1: Interactions between users, data and digital systems Topic 2: Real-world problems and solution requirements Topic 3: Innovative digital solutions
<b>Duration</b>	—
<b>Mode/length</b>	Source code with annotations: <ul style="list-style-type: none"><li>• Written: 4–6 A4 pages</li></ul> Documentation: <ul style="list-style-type: none"><li>• Multimodal: 8–10 A3 pages</li></ul> Demonstration of the functionality of the digital solution by video recording: <ul style="list-style-type: none"><li>• Multimodal: 2–4 minutes</li></ul>
<b>Individual / group</b>	Individual
<b>Other</b>	Title and contents pages, reference list and appendixes are not included in the page count. Student may use class time and their own time to develop a response.
<b>Resources</b>	Computers, internet, software, stimulus (technical proposal)

# Context

A technical proposal is used to inform the development of a digital innovation. A technical proposal includes detailed user requirements, diagrams and algorithms that outline how a proposed web application will interact with users and data stores.

# Task

Develop a new web application according to the requirements outlined in the provided technical proposal. Document the problem-solving process in Digital Solutions and demonstrate the functionality of the components of the digital solution in a video recording.

To complete this task, you must:

- recognise and describe
  - programmed and user-interface components
  - useability principles, including accessibility, effectiveness, safety, utility and learnability
- symbolise using mind maps and one or more of constructed sketches, annotated diagrams, images or screenshots of
  - the user and developer problem
  - algorithms communicated in pseudocode that demonstrate knowledge and understanding of programming features
  - interrelationships between user experiences and data in the prototype digital solution
- explain
  - internal and external data components and data structures using appropriate symbols, code, data samples and screenshots from the prototype digital solution with annotations
  - the solution from a user-experience perspective communicated by way of a collection of annotated images of the user-interface components
  - how programming elements and user-interface components connect communicated in an annotated diagram
  - the functionality, useability and efficiency of the coded components communicated through code comments and annotations
- analyse the problem, data sets and information to identify
  - data inputs
  - data and programmed components and their relationships to the structure of the prototype digital solution
  - the prototype's potential personal, social and economic impacts
- determine
  - solution requirements
    - required essential elements and features of user interface
    - data requirements
  - prescribed and self-determined criteria

- synthesise information and ideas to select the best approach for
  - user interfaces
  - data and programmed components of a prototype digital solution, e.g. annotated diagrams identifying and describing proposed components of the prototype digital solution
  - data repositories
  - programming to generate a prototype digital solution
- generate
  - code for the prototype digital solution demonstrating
    - selection
    - iteration
    - user input
    - data output
  - a prototype digital solution by combining the user interface, data and coded components
- evaluate against criteria
  - personal, social and economic impacts, supported by a collection of data samples or representations
  - accuracy and efficiency of the coded components, supported by a collection of annotated code segments in tables, diagrams and written paragraphs identifying errors and actions to make refinements
  - the solution from a user-experience perspective, supported by a collection of annotated images of the user-interface components
- make refinements and justified recommendations for current and future improvements.

## Stimulus

See the attached technical proposal.

## Checkpoints

- Term 2 Week 3: Submission of data requirements, identification of algorithms and some code and user interface
- Term 2 Week 6: Complete draft submission
- Term 2 Week 8: Final submission

## Authentication strategies

- Students will provide documentation of their progress at indicated checkpoints.
- The teacher will collect and annotate one draft.
- Students must acknowledge all sources.
- Students must submit a declaration of authenticity.

# Scaffolding

Your response must include:

- A3 pages that
  - demonstrate all phases of the problem-solving process communicate
  - communicate knowledge and understanding by way of annotated sketches, diagrams, images or screenshots
- a video
  - in mp4 file format
  - no larger than 200 MB
  - that demonstrates the functionality of the user interface, data and coded components of the prototype digital solution
- A4 pages of code with annotations explaining analysis, synthesis and evaluation decisions related to the code element or problem
- referencing of sources following the school's referencing style
- written and visual features, as well as grammatically accurate language conventions, to communicate your decision-making
- headings that organise and communicate the iterative phases of the problem-solving process in Digital Solutions.

# Instrument-specific marking guide (IA2): Project — digital solution (30%)

## Criterion: Retrieving and comprehending

### Assessment objectives

1. recognise and describe programming elements, user-interface components and useability principles
2. symbolise and explain programming information and ideas, data structures and interrelationships between user experiences and data of the digital prototype

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"> <li>• accurate and discriminating recognition and discerning description of relevant programming elements, user-interface components and useability principles</li> <li>• adept symbolisation and discerning explanation of algorithms and relevant programming information and ideas, data structures and interrelationships between user experiences and data of the digital prototype.</li> </ul>	7–8
<ul style="list-style-type: none"> <li>• accurate recognition and effective description of relevant programming elements, user-interface components and useability principles</li> <li>• methodical symbolisation and effective explanation of algorithms and relevant programming information and ideas, data structures and interrelationships between user experiences and data of the digital prototype.</li> </ul>	5–6
<ul style="list-style-type: none"> <li>• appropriate recognition and description of some programming elements, user-interface components and useability principles</li> <li>• competent symbolisation and appropriate explanation of algorithms and some information and ideas, and interrelationships between user experiences and data of the digital prototype.</li> </ul>	3–4
<ul style="list-style-type: none"> <li>• variable recognition and superficial description of programming elements, user-interface components or useability principles</li> <li>• variable symbolisation and superficial explanation of information, ideas or interrelationships.</li> </ul>	1–2
<ul style="list-style-type: none"> <li>• does not satisfy any of the descriptors above.</li> </ul>	0

## Criterion: Analysing

### Assessment objectives

- analyse the problem and information related to the technical proposal for a low-fidelity prototype digital solution
- determine user interface, data, programmed and solution requirements of the digital solution and prescribed and self-determined criteria

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"><li>insightful analysis of the problem and relevant contextual information to identify the essential elements and features of user interface, data and programmed components and their relationships to the structure of the low-fidelity prototype digital solution</li><li>astute determination of the user interface, data, programmed and solution requirements of the digital solution and essential prescribed and self-determined criteria.</li></ul>	7–8
<ul style="list-style-type: none"><li>considered analysis of the problem and relevant contextual information to identify the relevant elements and features of user interface, data and programmed components and their relationships to the structure of the low-fidelity prototype digital solution</li><li>logical determination of the user interface, data, programmed and solution requirements of the digital solution and effective prescribed and self-determined criteria.</li></ul>	5–6
<ul style="list-style-type: none"><li>appropriate analysis of the problem and contextual information to identify some elements and features of user interface, data and programmed components and their relationships to the structure of the low-fidelity prototype digital solution</li><li>reasonable determination of the user interface, data, programmed and solution requirements of the digital solution and some prescribed and self-determined criteria.</li></ul>	3–4
<ul style="list-style-type: none"><li>superficial analysis of the problem or partial information to identify aspects of elements or features of the low-fidelity prototype digital solution</li><li>vague determination of some solution requirements of the digital solution and some criteria.</li></ul>	1–2
<ul style="list-style-type: none"><li>does not satisfy any of the descriptors above.</li></ul>	0

## Criterion: Synthesising and evaluating

### Assessment objectives

5. synthesise information and ideas to determine data elements, user interface and programmed components for a digital solution
6. generate user interfaces and programmed components of the digital solution
7. evaluate impacts, components and the digital solution against prescribed and self-determined criteria to make refinements and justified recommendations

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"> <li>• coherent and logical synthesis of relevant information and ideas to determine data elements, user interface and programmed components for a digital solution</li> <li>• purposeful generation of efficient user interface and programmed components of the digital solution</li> <li>• critical evaluation of impacts, user experience and coded components and the digital solution against essential prescribed and self-determined criteria to make discerning refinements and astute recommendations justified by data.</li> </ul>	9–10
<ul style="list-style-type: none"> <li>• logical synthesis of relevant information and ideas to determine data elements, user interface and programmed components for a digital solution</li> <li>• effective generation of user interface and programmed components of the digital solution</li> <li>• reasoned evaluation of impacts, user experience and coded components and the digital solution against effective prescribed and self-determined criteria to make effective refinements and considered recommendations justified by data.</li> </ul>	7–8
<ul style="list-style-type: none"> <li>• simple synthesis of information and ideas to determine data elements, user interface and programmed components for a digital solution</li> <li>• adequate generation of user interface and programmed components of the digital solution</li> <li>• feasible evaluation of impacts, user experience and coded components and the digital solution against some prescribed and self-determined criteria to make adequate refinements and fundamental recommendations justified by data.</li> </ul>	5–6
<ul style="list-style-type: none"> <li>• rudimentary synthesis of partial information or ideas to determine data elements, user interface or programmed components</li> <li>• partial generation of user interface and programmed components of the digital solution</li> <li>• superficial evaluation of impacts, user experience components or the solution against some criteria.</li> </ul>	3–4
<ul style="list-style-type: none"> <li>• unclear combination of information, ideas or solution components</li> <li>• identification of a change to an idea or a solution.</li> </ul>	1–2
<ul style="list-style-type: none"> <li>• does not satisfy any of the descriptors above.</li> </ul>	0



## Criterion: Communicating

### Assessment objectives

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

The student work has the following characteristics:	Marks
<ul style="list-style-type: none"><li>• discerning decision-making about, and fluent use of<ul style="list-style-type: none"><li>- written and visual features to communicate about a solution</li><li>- language for a technical audience</li><li>- grammatically accurate language structures</li><li>- referencing and investigation conventions.</li></ul></li></ul>	2-3
<ul style="list-style-type: none"><li>• variable decision-making about, and inconsistent use of<ul style="list-style-type: none"><li>- written and visual features</li><li>- suitable language</li><li>- grammar and language structures</li><li>- referencing or investigation conventions.</li></ul></li></ul>	1
<ul style="list-style-type: none"><li>• does not satisfy any of the descriptors above.</li></ul>	0

# Stimulus

## Technical proposal for a new web application

### Identification

Ocean wave data is collected regularly by the Queensland Government. Monitoring wave movements can help meteorologists identify conditions that could endanger lives or damage property (Queensland Government 2017). To supplement existing warning systems, you are required to build a new web application that allows meteorologists to:

- update recently transmitted wave datasets in a central database quickly and easily
- automatically analyse the data using pre-programmed algorithms
- generate an area-specific warning signal or message registered users if appropriate.

The web application to be developed for the Department of Science, Information Technology and Innovation within the Queensland Government must:

- be clear, consistent and comply with accessibility guidelines (Queensland Government 2016a). A web writing and style guide has been provided with suggestions for writing and style techniques that should be used.
- include appropriate attribution to data and images used and must comply with copyright law
- include a link to the legal disclaimer at [www.qld.gov.au/legal/disclaimer](http://www.qld.gov.au/legal/disclaimer) on the landing page.

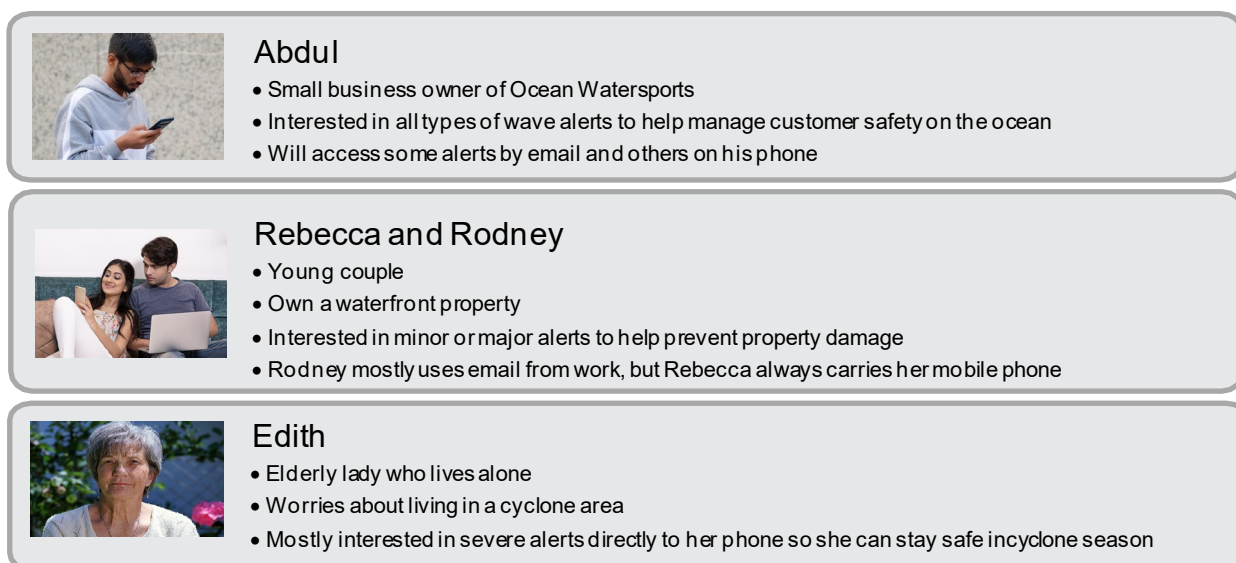
An optional 'Customer user experience' web template be used for the user interface:

[www.forgov.qld.gov.au/information-and-communication-technology/communication-and-publishing/website-and-digital-publishing/website-standards-guidelines-and-templates/consistent-user-experience-standard/consistent-user-experience-standard-v3.0/cue-template](http://www.forgov.qld.gov.au/information-and-communication-technology/communication-and-publishing/website-and-digital-publishing/website-standards-guidelines-and-templates/consistent-user-experience-standard/consistent-user-experience-standard-v3.0/cue-template). This includes sample HTML templates and CSS styles that can be adapted for the new web application. You will need to modify this template to satisfy useability principles.

### Interactions

Proto-personas have been developed for potential users of the website (see Figure 1).

Figure 1: User profiles for the new web application



## Component specifications

### Data

- Administrators are able to upload wave data to the website from a .csv file.
- Seven (7) days of detailed wave data for one region, including the following fields
  - Site — wave site
  - DateTime — 30 minute interval at which the recording was taken
  - Hsig — significant wave height
  - Hmax — maximum wave height
  - Tz — zero upcrossing wave period
  - Tp — peak energy wave period
  - Direction — direction that the waves came from
  - SST — sea surface temperature

**Note:** Sample data is available from [www.data.qld.gov.au/dataset/coastal-data-system-near-real-time-wave-data](http://www.data.qld.gov.au/dataset/coastal-data-system-near-real-time-wave-data).

- Data about normal wave height ranges for the following wave sites
  - Abbot Point
  - Albatross Bay (Weipa)
  - Brisbane
  - Bundaberg
  - Cairns
  - Caloundra
  - Emu Park
  - Gladstone
  - Gold Coast
  - Hay Point
  - Mackay
  - Mooloolaba
  - North Moreton Bay
  - Townsville
  - Tweed Heads

**Note:** Data sources are available from [data.qld.gov.au/dataset?q=Coastal%20Data%20System%20%E2%80%93%20Waves](http://data.qld.gov.au/dataset?q=Coastal%20Data%20System%20%E2%80%93%20Waves).

- An incorrect user registration will not be stored in the database.
- Register users and maintain the following details for registered users
  - name, address, email and mobile number
  - up to three wave sites for which the user has registered to receive alerts

- the category of alert the user has registered to receive for each site, e.g. all, minor, major, or severe
- the type of warning signal or message to be sent to the user either by email or SMS.
- Provide the difference between the wave height recorded and the normal wave height (in metres) for each site selected by the user.

## User experience

- The application must have a responsive web interface based on the wireframes described on [www.forgov.qld.gov.au/cue-module2-elements-screen-layout](http://www.forgov.qld.gov.au/cue-module2-elements-screen-layout). This includes interfaces for
  - user registration and alert configuration
  - data upload, analysis and alert confirmation.
- The web application complies with
  - government web design standards
  - the *Australian Privacy Act (1988)*
  - Australian accessibility standards (see Table 1).
- Users are able to register personal details with the site.
- Types of alerts pre-selected by a user are emailed or sent by SMS.

## Code

- an algorithm adapted and modified from the algorithm below to process the uploaded data and raise any necessary alerts for registered users
- code that processes uploaded data and alerts registered users

```

Run query B to determine which users would receive an alert and what type
of alert should be sent. For each site in query B
  Run query A to determine difference in metres between wave height
  recorded and normal wave height.
  For each row in query A
    Initialise weatherWarning to false
    If difference greater than 5
      metres: Set
      weatherWarning to
      severe
    Else If difference greater
      than 3 metres: Set
      weatherWarning to major
    Else If difference greater than or
      equal to 1 metre: Set
      weatherWarning to minor
  Else
    Set weatherWarning to false
    For each user in the site group:
    If weatherWarning is equal to user
      alert type Get user contact
      details
      Send alert
  
```

- an algorithm to validate user input of email and/or SMS contact details on the user registration interface
  - data validation code that provides appropriate feedback to the user about their input
  - code that stores validated user registration details in the user registration table
- an algorithm and code to read records from the waves.csv file and store them in a database table.

**Table 1: Accessibility guidelines adapted from the Australian accessibility standards**

Accessibility guidelines
<p>Page titles:</p> <ul style="list-style-type: none"> <li>• must appear in the browser tab for all pages</li> <li>• must be appropriate for the page</li> <li>• must be different for each page.</li> </ul>
<p>Alt text:</p> <ul style="list-style-type: none"> <li>• must be used for all content images (except decorative images)</li> <li>• attribute is set to null for decorative images</li> <li>• appropriately describes the content of the image to which it relates</li> <li>• gets larger when pages are zoomed.</li> </ul>
<p>Headings:</p> <ul style="list-style-type: none"> <li>• are on every page (at least one)</li> <li>• levels on each page have a meaningful hierarchy.</li> </ul>
<p>Zooming of pages:</p> <ul style="list-style-type: none"> <li>• results in correct display of the page with no horizontal scrolling</li> <li>• allows all buttons to remain visible.</li> </ul>
<p>Non-mouse navigation (keystrokes or tabs):</p> <ul style="list-style-type: none"> <li>• of page is in a logical order</li> <li>• allows access to all page elements.</li> </ul>
<p>Fields:</p> <ul style="list-style-type: none"> <li>• in forms and other form controls have a visible label to allow interaction with voice input and increase the clickable area</li> <li>• that are mandatory are clearly indicated and do not rely on colour alone</li> <li>• with required formats, such as dates (year, month, day), are clearly indicated.</li> </ul>
<p>Error messages (or validation messages):</p> <ul style="list-style-type: none"> <li>• are clear and specific</li> <li>• do not cause the form to be completely reset.</li> </ul>
<p>Accessibility options include:</p> <ul style="list-style-type: none"> <li>• general instructions for user input at the top of the form or section to which they relate</li> <li>• text transcripts provided for audio and video elements</li> <li>• appropriate contrast ratio between text and background (colour contrast)</li> <li>• a five-second time limit for all moving or flashing content, and the content can be disabled or controlled by the user.</li> </ul>

## References

Queensland Government, 2016, Elements of screen layout, [www.forgov.qld.gov.au/cue-module2-elements-screen-layout](http://www.forgov.qld.gov.au/cue-module2-elements-screen-layout) accessed 11/6/2017

Queensland Government, 2016a, Web writing and style guide, [www.forgov.qld.gov.au/web-writing-and-style-guide](http://www.forgov.qld.gov.au/web-writing-and-style-guide) accessed 11/6/2017

Queensland Government, 2017, About wave monitoring, [www.qld.gov.au/environment/coasts-waterways/beach/waves](http://www.qld.gov.au/environment/coasts-waterways/beach/waves) accessed 11/6/2017



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