# Digital Solutions 2019 v1.2

## IA2 assessment instrument

### Project - digital solution (30%)

#### Assessment objectives

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

3. analyse the problem and information related to the technical proposal for a low-fidelity prototype digital solution

4. determine user interface, data, programmed and solution requirements of the digital solution and prescribed and self-determined criteria

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

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

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| **Subject** | Digital Solutions | **Instrument no.** | IA2 |
| **Technique** | Project – digital solution | | |
| **Unit** | Unit 3: Digital innovation | | |
| **Topics** | Topic 1: Interactions between users, data and digital systems  Topic 2: Real-world problems and solution requirements  Topic 3: Innovative digital solutions | | |
| **Conditions** | | | |
| **Duration** | Up to 8 weeks | | |
| **Mode** | Multimodal | **Length** | * 8-10 A3 pages * 2-4 minute demonstration of the functionality of the user interface, data and coded components of the digital solution by video recording * 4-6 A4 pages of code with annotations |
| **Individual / group** | Individual | **Seen / unseen** | Seen |
| **Resources available** | 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. | | | |
| **Stimulus** | | | |
| See the attached technical proposal. | | | |
| **To complete this task, you must:** | | | |
| * **recognise and describe**   + programmed and user-interface components   + useability principles, including accessibility, effectiveness, safety, utility and learnability * **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 * **explain**   + internal and external data components and data structures using appropriate symbols, code, data samples and screenshots from the prototype web application with annotations   + the prototype web application 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 on the 4–6 A4 pages * **analyse** the prototype web application problem and information to **identify**   + data inputs   + data and programmed components and their relationships to the structure of the prototype web application   + the prototype web application’s potential personal, social and economic impacts * **determine**   + solution requirements that include     - essential elements and features of the user interface based on useability principles     - data structures and linkage to interface and code   + prescribed and self-determined criteria * **synthesise** ideas and information about solutions for   + user interfaces   + data and programmed components of the prototype web application, e.g. annotated diagrams identifying and describing proposed components of the prototype web application   + data repositories   + programming to generate a prototype web application * **generate**   + sample code for the digital prototype on the 4–6 A4 pages, demonstrating     - selection     - iteration     - user input     - data output   + a prototype web application 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 prototype web application 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. | | | |
| **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 | | | |

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| **Criterion** | **Marks allocated** | **Result** |
| **Retrieving and comprehending**  Assessment objectives 1, 2 | 8 |  |
| **Analysing**  Assessment objectives 3, 4 | 8 |  |
| **Synthesising and evaluating**  Assessment objectives 5, 6, 7 | 10 |  |
| **Communicating**  Assessment objective 8 | 4 |  |
| **Total** | 30 |  |
| **Authentication strategies** | | |
| * Students will provide documentation of their progress after three weeks and a complete draft after six weeks. | | |
| * Students must acknowledge all sources. | | |
| * Students must submit a declaration of authenticity. | | |
| * The teacher will collect copies of the student response and monitor at key junctures. | | |
| * The teacher will compare the responses of students who have worked together in groups. | | |
| * The teacher will conduct interviews or consultations with each student as they develop the response. | | |
| **Scaffolding** | | |
| Your response must include:   * A3 pages that   + demonstrate all phases of the problem-solving process   + communicate knowledge and understanding by way of annotated sketches, diagrams, images or screenshots * a video   + in mp4 file format   + no larger than 200 MB   + demonstrating 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

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

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| **The student work has the following characteristics:** | **Marks** |
| * accurate and discriminating recognition and discerning description of relevant programming elements, user-interface components and useability principles * 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. | 7-8 |
| * accurate recognition and effective description of relevant programming elements, user-interface components and useability principles * 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. | 5-6 |
| * appropriate recognition and description of some programming elements, user-interface components and useability principles * competent symbolisation and appropriate explanation of algorithms and some information and ideas, and interrelationships between user experiences and data of the digital prototype | 3-4 |
| * variable recognition and superficial description of programming elements, user-interface components or useability principles * variable symbolisation and superficial explanation of information, ideas or interrelationships. | 1-2 |
| * does not satisfy any of the descriptors above. | 0 |

Criterion: Analysing

### Assessment objectives

1. analyse the problem and information related to the technical proposal for a low-fidelity prototype digital solution

2. determine user interface, data, programmed and solution requirements of the digital solution and prescribed and self-determined criteria

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| **The student work has the following characteristics:** | **Marks** |
| * 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 * astute determination of the user interface, data, programmed and solution requirements of the digital solution and essential prescribed and self-determined criteria. | 7-8 |
| * 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 * logical determination of the user interface, data, programmed and solution requirements of the digital solution and effective prescribed and self-determined criteria. | 5-6 |
| * 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 * reasonable determination of the user interface, data, programmed and solution requirements of the digital solution and some prescribed and self-determined criteria. | 3-4 |
| * superficial analysis of the problem or partial information to identify aspects of elements or features of the low-fidelity prototype digital solution * vague determination of some solution requirements of the digital solution and some criteria. | 1-2 |
| * does not satisfy any of the descriptors above. | 0 |

Criterion: Synthesising and evaluating

### Assessment objectives

1. synthesise information and ideas to determine data elements, user interface and programmed components for a digital solution

2. generate user interfaces and programmed components of the digital solution

3. evaluate impacts, components and the digital solution against prescribed and self-determined criteria to make refinements and justified recommendations

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| **The student work has the following characteristics:** | **Marks** |
| * coherent and logical synthesis of relevant information and ideas to determine data elements, user interface and programmed components for a digital solution * purposeful generation of efficient user interface and programmed components of the digital solution * 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. | 9-10 |
| * logical synthesis of relevant information and ideas to determine data elements, user interface and programmed components for a digital solution * effective generation of user interface and programmed components of the digital solution * 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. | 7-8 |
| * simple synthesis of information and ideas to determine data elements, user interface and programmed components for a digital solution * adequate generation of user interface and programmed components of the digital solution * 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. | 5-6 |
| * rudimentary synthesis of partial information or ideas to determine data elements, user interface or programmed components * partial generation of user interface and programmed components of the digital solution * superficial evaluation of impacts, user experience components or the solution against some criteria. | 3-4 |
| * unclear combination of information, ideas or solution components * identification of a change to an idea or a solution. | 1-2 |
| * does not satisfy any of the descriptors above. | 0 |

Criterion: Communicating

### Assessment objectives

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

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| **The student work has the following characteristics:** | **Marks** |
| * discerning decision-making about, and fluent use of   + written and visual features to communicate about a solution   + language for a technical audience   + grammatically accurate language structures   + referencing and project conventions. | 3-4 |
| * variable decision-making about, and inconsistent use of   + written and visual features   + suitable language   + grammar and language structures   + referencing or project conventions. | 1-2 |
| * does not satisfy any of the descriptors above. | 0 |

# Stimulus

## Technical proposal for a new web application

### Identification

Bicycle counters have been installed in Brisbane that provide 24/7 bicycle counting data. The data collected from this can assist in the development of action plans to encourage more cycling (Queensland Government 2017). To supplement existing journey planning systems, you are required to build a new web application that allows site administrators to:

* update recently collected cyclist counts into a central database, quickly and easily
* automatically analyse the data using pre-programmed algorithms
* generate area-specific congestion alerts or warnings to registered cyclists, if requested

The web application to be developed for the Transport and Main Roads 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 available from [www.forgov.qld.gov.au/cue-template-downloads](http://www.forgov.qld.gov.au/cue-template-downloads) can be used for the user interface. 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

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|  | Bernard   * Lives in Toowong and rides slowly along the Brisbane North Bank to work every day as a council worker. * Only interested in severe congestion alerts. * Doesn’t have internet or own a computer, so would need congestion alerts via phone or a digital public display. |
|  | Gwyneth   * Pro-triathlete, lives out at Redcliffe and trains every day by riding over the Ted Smout Bridge, predominantly during off-peak hours, as any traffic can impact her training. * Interested in all alerts or advice that will be offered. * Uses her phone, tablet and laptop devices to manage and plan her training routes via the internet. |
|  | Rowena   * Mother of her 4-year-old son Paulo, who ride together to school every morning through Mowbray Park, East Brisbane. She then drops off her son and rides on to work. * Interested in major or severe congestion alerts that will affect her travel. * Works in an office tower, so the majority of her digital access is via a Windows PC with Google Chrome |

### Component Specifications

#### Data

* Administrators are able to upload bicycle traffic data to the website from a .csv file.
* At least one month of 24-hour cyclist traffic data taken from each collection point, including the following fields:
  + Site – the collection point
  + Month – the month of data collection
  + Year – year of data collection
  + Hours – the 60-minute interval at which a recording was taken (in 24-hour time)
  + Days – Each day of the week, the count of cyclists recorded

Note: Sample data is available from <https://data.qld.gov.au/dataset/average-bicycle-counts-by-day-and-hour>

* Data about cyclist traffic for the following bicycle traffic observation points:
  + Mowbray Park, East Brisbane
  + Toowong Overpass, Brisbane
  + Northbank, Brisbane
  + Sandgate Road Northbound Near Julia Street
  + Sandgate Road Southbound Near Northgate Road
  + South Pine Road Northbound
  + South Pine Road Southbound near Coorparoo Road
  + Normanby West, Brisbane
  + Gaza Road Cycle Path Adjacent to M1
  + Ted Smout Bridge
* 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 bicycle traffic observation points for which the user has registered to receive congestion alerts
  + the category of congestion alerts the user has registered to receive for each observation point, 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 traffic observed and the average traffic expected for each bicycle traffic observation 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 bicycle traffic congestion alert configuration
  + data upload, analysis and bicycle traffic congestion 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 bicycle traffic congestion alerts pre-selected by a user are emailed or sent via SMS.

#### Code

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

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| Run query B to determine which users would receive a congestion alert and what type of alert should be sent For each observation point in query B  Run query A to determine difference in numbers between traffic count recorded and expected traffic count.   For each row in query A  Initialise congestionWarning to false   If difference greater than 500% of normal bicycle traffic expected:   Set congestionWarning to severe  Else If difference greater than 350% of normal bicycle traffic expected:  Set congestionWarning to major  Else If difference greater than 200% of normal bicycle traffic expected:  Set congestionWarning to minor  Else   Set congestionWarning to false   For each user in the site group:   If congestionWarning is equal to user congestion 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 bicycle traffic count .csv file(s) and store them in a database table.

##### Table 1: Accessibility guidelines adapted from the Australian accessibility standard

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| **Accessibility guidelines** |
| Page titles:   * must appear in the browser tab for all pages * must be appropriate for the page * must be different for each page. |
| Alt text:   * must be used for all content images (except decorative images) * attribute is set to null for decorative images * appropriately describes the content of the image to which it relates * gets larger when pages are zoomed. |
| Headings:   * are on every page (at least one) * levels on each page have a meaningful hierarchy |
| Zooming of pages:   * results in correct display of the page with no horizontal scrolling * allows all buttons to remain visible. |
| Non-mouse navigation (keystrokes or tabs):   * of page is in a logical order * allows access to all page elements. |
| Fields:   * in forms and other form controls have a visible label to allow interaction with voice input and increase the clickable area * that are mandatory are clearly indicated and do not rely on colour alone * with required formats, such as dates (year, month, day), are clearly indicated |
| Error messages (or validation messages):   * are clear and specific * do not cause the form to be completely reset. |
| Accessibility options include:   * general instructions for user input at the top of the form or section to which they relate * text transcripts provided for audio and video elements * appropriate contrast ratio between text and background (colour contrast) * a five-second time limit for all moving or flashing content, and the content can be disabled or controlled by the user |

### References

Queensland Government, 2016, *Elements of screen layout,*

<https://www.forgov.qld.gov.au/cue-module2-elements-screen-layout> accessed 11/6/2017

Queensland Government, 2016a, *Web writing and style guide,*

<https://www.forgov.qld.gov.au/web-writing-and-style-guide> accessed 11/6/2017

Queensland Government, 2017, *Queensland Cycling Strategy*,

<https://blog.tmr.qld.gov.au/cycling/> accessed 10/10/18