# Digital Solutions 2019 v1.2

## Unit 2 assessment instrument

### Project - digital solution

#### Unit objectives

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

1. recognise and describe programming elements, data and useability principles, and data management processes

2. symbolise and explain information, ideas and data flow relationships within and between systems related to programming problems

3. analyse problems and information related to the selected technology context

4. determine solution requirements and prescribed and self-determined criteria of a programming problem

5. synthesise information and ideas to determine possible digital solutions

6. generate user interface and programmed components of the prototype digital solution

7. evaluate impacts, components and solutions against criteria to make refinements and justified recommendations

8. make decisions about and use mode-appropriate features, language and conventions for particular purposes and contexts.

*The assessment objectives used in the ISMG below have been contextualised to reflect these unit objectives.*

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| **Subject** | Digital Solutions | | |
| **Technique** | Project – digital solution | | |
| **Unit** | Unit 2: Application and data solutions | | |
| **Topics** | Topic 1: Data-driven problems and solution requirements  Topic 2: Data and programming techniques  Topic 3: Prototype data 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 and coded components of the digital solution by video recording * 4-6 A4 pages of code with annotations |
| **Individual / group** | Individual | **Other** | * The reference list is not included in the page count. * Schools implement authentication strategies that reflect QCAA guidelines. |
| **Resources available** | * Computers * Internet * Stimulus (technical proposal) | | |
| **Context** | | | |
| Web-based information systems deliver real-time data services for concurrent users irrespective of device or location. Given the proliferation of these services, consideration must be given to issues such as device and data independence, as well as ensuring the security, integrity and ethical use of data, and enabling a high speed, efficient, accurate and cost-effective service.  You are required to build a proof of concept information system, accessible via a web interface, that will manage a hierarchy of tasks for the client described in the technical proposal. | | | |
| **Task** | | | |
| You must document the problem-solving process used to develop and generate the user interface, data storage and transaction requirements, as well as the programmed components of a prototype for a new information system web application. The new application must address the requirements of the scenario in the technical proposal provided. Demonstrate the functionality of the components of the prototype information system web application 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**   + 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. | | | |
| **Stimulus** | | | |
| See technical proposal at end of document | | | |
| **Checkpoints** | | | |
| □ Term 3 Week 5: Submit exploration of solutions, identification of algorithms, user interface sketches and data flow diagram | | | |
| □ Term 3 Week 8: Complete draft submission | | | |
| □ Term 3 Week 10: 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 at indicated checkpoints. | | |
| * 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 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. | | |

# Technical Proposal

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| **Identification** | |
| **Your role** | For this project, you assume the simulated roles of an information systems analyst, designer and developer (including UX designer and developer). |
| **Client** | Rapid Charge |
| **Background** | Coupling power and data solutions has long existed. Powerline solutions that use higher than 50/60Hz frequencies to transport data can turn home electrical wall outlets into network ports (with the right adapter). Power over Ethernet (PoE) is a technology that lets network cables carry electrical power. At 5V, USB 3.0 can deliver 4.5W, whereas USB Power Delivery (PD) can deliver 100W at 24V.  By trying to overclock the polling rate of a USB mouse for increased precision, the client inadvertently discovered a way to deliver a safe, controlled “power surge” through the Power Delivery specification of any standard USB-C / USB 3.X device, capable of charging a flat iPhone 12 Pro within seconds. The client patented this technology their namesake Rapid Charge.  Using a [WMI](https://docs.microsoft.com/en-us/windows/win32/wmisdk/wmi-start-page) script, Rapid Charge are able to achieve this safe, controlled “power surge” remotely, and thus can be triggered by any device with USB-C / USB 3.X port, internet connection and web browser. When triggered on an earlier USB specification (2.0 or 1.0), charge time results are mixed. |
| **Solution required** | A *prototype* of an information system to manage and administer Rapid Charge functionality as described below, with accessible web-based front and back end conforming to strict usability standards.  The **prescribed** functionality for this site includes:   * Let the user register their unique phone number (e.g. 0412 345 678) with the site, and while registering, users must “link” their phone number to one of the thirteen currently supported phone models found in the SQLite database file provided. * When users want to “Rapid Charge” their phone device, after plugging the phone in via USB, users enter their unique mobile phone number which brings up their phone model (e.g. Samsung Galaxy S10e), ready for charging. * *Simulate a Rapid Charge*. This could be a button that says “charge”, that simply redirects to another page on the site. You can assume that all charges are successful provided the user has (A) successfully registered and linked their phone number to a supported phone model, (B) has specified their phone number before charging and (C) does not unplug their phone prior to the battery charge reaching 100%.   The site should meet useability requirements and may implement some extended functionality found below in the further specifications section. |
| **Potential *interactions* with the web application** | |  |  | | --- | --- | |  | **Who**: Bill, cattle farmer  **Where**: A small country town in rural Queensland  **Why**:   * Still using an iPhone 4 from 2010, which was an upgrade from his Nokia 5180i (1999) that ran on a CDMA network * No 3G, 4G or 5G in the area. The local township has a library with satellite internet, which is terribly slow on a cloudy day. * The library has one old Windows 7 PC with a single USB 1.0 port running the Firefox browser. * Bill has limited technical ability. He knows the site only supports iPhone 11s, which is the setting he uses to charge his phone. | |  | **Who**: Sally, founder of Rapid Charge  **Where:** Queensland metro  **Why**:   * Wants to use both phone browser and laptop to track user metrics on her new web application * Wants to INSERT, UPDATE or DELETE compatible phones via web interface | |  | **Who**: Raoul, mobile phone hacker  **Where**: unknown  **Why:**   * Finds exploits in phone hardware (using firmware flashing) and software (hijacking phone OS with malicious client-side scripts) to retrieve private or sensitive data * On-sells data mined to interested commercial parties for monetary gain (paid in bitcoins). | |  | **Who**: Ian, salesman for Windows phones  **Where:** travels around Australia  **Why**:   * Sells phone stock to mobile phone vendors * Interested in compatibility of the device with Rapid Charge * Selling points important to Ian’s phones include Accessibility, Privacy, and Environmental friendliness. | |
| **Specifications** | |
| **Data** | *Potential data storage requirements include*:  Supported Phone data:  A list of thirteen currently support Rapid Charge phones has been provided. The decision of which data fields should be kept is left as a job for the developer.  Registered Customer data:   * Unique phone number – phone numbers can exist once and once only * Phone number must be linked to a phone model that is one of the thirteen supported phones   Other potential data:   * Dates and times for charge histories * What amount of charge was required (as a percentage) * Time it took to complete charge * Charge status log, which if the user unplugs the phone during a Rapid Charge, details the cause of the failed charge * Any non-specified customer or phone data that could be of commercial interest to the Rapid Charge company |
| **Code** | *Potential operational requirements include*:  Display thirteen compatible phones  The compatible phone types should be accessible from the home page, and when registering a phone number, should be available in an appropriate way for selection. Compatible phone data may be live edited or modified by admin.  Calculate a Paywall  The paywall Rapid Charge is investigating for its services will be based on the milliampere hours (mAh) capacity of the battery:   * A 1000 mAh battery lasts 1 hour * A 2500 mAh battery lasts 2 hours and 30 minutes.   Given that batteries with less battery longevity will require more frequent charging – and thus more repeat business and exposure to advertising – Rapid Charge is proposing the following surcharges:   |  |  |  | | --- | --- | --- | | **Battery Capacity** | **Price per charge** | **Frequency of charge** | | Less than 2 hours | 20c | Often | | Between 2 and 4 hours | 50c | Sometimes | | Over 4 hours | $1 | Rarely |   Worst Case Charge Time Prediction  Predict the worst case charge time depending on the % of battery remaining. As a rough guide, Rapid Charge, regardless of battery capacity (mAh), can charge any mobile phone battery from:   |  |  |  | | --- | --- | --- | |  | **0% power** | **50% power** | | USB 1.X connector | 60 seconds | 30 seconds | | USB 2.X connector | 20 seconds | 10 seconds | | USB 3.X connector | 5 seconds | 2.5 seconds |   Phone Storage Backup  Rapid Charge is thinking of adding a *Premium User* tier to its site, which allows users to make a cloud backup of their phone storage (GB) prior to charging, as a “failsafe” in case of electrical fault. If this was the case, the time of the upload could be predicted. No uploads longer than 60 minutes will be allowed:   |  |  |  | | --- | --- | --- | | **GB** | **Upload** (100Mbps / 12MBps) | **Upload** (24Mbps / 3MBps) | | 8 | 11.25 minutes | 45 minutes | | 16 | 22.5 minutes |  | | 32 | 45 minutes |  |   In addition to this, a download time could be predicted to recover a backup. A 16GB download on a 1000Mbps / 120MBps connection would take 2 minutes.  Other Ideas   * Metrics accumulation and display: frequency or quantity of charge required, grouped by user or phone type. Other useful data metrics? * Ethical data collection: phone usage in relation to charge requirements, which could include but not limited to parsing and storing call logs, location data, files or other sensitive data (such as social media integration) if user is willing to share (requires disclaimer). |
| **Interface** | * Responsive template provided (**rapidcharge.zip**) – this is a skeletal responsive framework with CSS styling for common HTML elements using Bootstrap. The actual UX design for this application is left as a job for the developer. * Modifications to the template are welcome provided:   + Intuitiveness (e.g. breadcrumb navigation) and accessibility (e.g. tooltips, alt text, contrasting colours) are guiding principles.   + Modifications should conform to the W3 standards. A good benchmarking tool for this is the Queensland Government [Consistent User Experience Standard](https://www.forgov.qld.gov.au/cue) |

# 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 |

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| **Marks** | **LOA** |
| **30** | **A+** |
| **29** |
| **28** | **A** |
| **27** |
| **26** | **A-** |
| **25** |
| **24** | **B+** |
| **23** |
| **22** | **B** |
| **21** |
| **20** | **B-** |
| **19** |
| **18** | **C+** |
| **17** |
| **16** | **C** |
| **15** |
| **14** | **C-** |
| **13** |

ISMG to LOA  
Note: Your grade will be awarded holistically. The “marks-to-grade” ratios shown below are a guide, and not to be taken as a determinant of final award:

|  |  |
| --- | --- |
| **Marks** | **LOA** |
| **12** | **D+** |
| **11** |
| **10** | **D** |
| **9** |
| **8** | **D-** |
| **7** |
| **6** | **E+** |
| **5** |
| **4** | **E** |
| **3** |
| **2** | **E-** |
| **1** |