**Sample Course Outline**

Computer Science

ATAR Year 12

**Acknowledgement of Country**

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# Sample course outline

# Computer Science – ATAR Year 12

## Unit 3: Design and development of programming and networking solutions

| **Week** | **Syllabus Content** | |
| --- | --- | --- |
| **Knowledge** | **Skills** |
| 1 | **Course introduction**   * overview of Unit 3 * assessment requirements   **Programming**  **Good programming practice**  Framework for development   * investigate   + problem description   + define requirements   + development schedule (including Gantt charts) * design   + design data structures   + design and test algorithm * develop   + develop and debug code   + unit testing and use of live data * evaluate   + user acceptance testing   + developer retrospective * compare common development processes   + linear   + iterative * good programming practice, including:   + validate input before processing   + a clear and uncluttered mainline   + one logical task per subroutine   + use of stubs   + appropriate use of control structures and data structures   + writing for subsequent maintenance   + version control   + regular backup   + exception handling   + functions are able to return a single data structure or value |  |
| 2–3 | **Programming skills and concepts**   * program control structures, including:   + sequence   + selection   + iteration     - post-test     - pre-test * characteristics of data types used in solutions, including:   + integer   + float   + string   + Boolean * modular coding using functions, parameters and arguments   + scope of variables (Global, Local) * characteristics of the following data structures:   + arrays:     - one-dimensional arrays     - two-dimensional arrays   + dictionaries | **Programming skills and concepts**   * apply, using pseudocode and a programming language, program control structures in solutions * apply, using pseudocode and a programming language, data types used in solutions as variables * apply, using pseudocode and a programming language, modular coding using functions, parameters and arguments * use different types of operators   + arithmetic operators (+, -, \*, /, %)   + relational operators (==, !=, >, =, <=)   + logical operators (AND, OR, NOT) * reading and writing of complex logical expressions including:   + Boolean operators (AND, OR, NOT)   + logical order of precedence * apply, using pseudocode and a programming language, the following data structures:   + arrays:     - one-dimensional arrays     - two-dimensional arrays * dictionaries   **Good programming practice**   * apply common development processes * apply good programming practice when developing a software solution, including:   + validate input before processing   + a clear and uncluttered mainline   + one logical task per subroutine   + use of stubs   + appropriate use of control structures and data structures   + writing for subsequent maintenance   + version control   + regular backup   + recognition of relevant social and ethical issues   + exception handling   + functions return a single data structure or value |
| 4–5 | **Structured algorithms**   * effective structure of code   + use of a modular approach, including functions and classes   + use of stubs to represent incomplete modules   + parameter passing * common algorithms:   + Big O notation   + search algorithms     - linear search     - binary search   + sort algorithms:     - bubble sort     - insertion sort     - selection sort | **Structured algorithms**   * use pseudocode and/or programming language for representing algorithms * create code with effective structure   + use of a modular approach, including functions and classes   + parameter passing   + use of stubs to represent incomplete functions |
| 6–7 | **Testing**   * acceptance testing of functional requirements based on user needs * the use of live test data to ensure that testing accurately reflects the expected environment in which the new system will operate   + large file sizes   + mix of transaction types   + response times   + volume of data (load testing) * validation of the solution with the design specifications * generating relevant test data for complex solutions * comparison of actual with expected output * unit tests to ensure code performs correctly   **Error detection and debugging code**   * the process of detecting and correcting errors, including:   + types of error     - syntax errors     - logic errors     - runtime errors, including:       * arithmetic overflow       * division by zero       * index out of range   + methods of error detection and correction     - methodical approach to the isolation of logic errors     - use of debugging techniques       * breakpoints       * print statements     - desk checking (trace tables)     - comparison of actual with expected output | **Testing**   * comparison of the solution with the design specifications * generating relevant test data for complex solutions * comparison of actual with expected output   **Error detection and debugging code**   * the process of detecting and correcting errors, including:   + types of error     - syntax errors     - logic errors     - runtime errors, including:       * arithmetic overflow       * division by zero   index out of range   * + methodical approach to the isolation of errors     - use of debugging techniques       * breakpoints       * print statements     - desk checking (trace tables)     - comparison of actual with expected output |
| 8 | **Object-oriented programming**   * characteristics of the following object-oriented concepts:   + classes   + objects   + attributes   + methods   + abstraction and polymorphism   + instantiation   + inheritance   + encapsulation | **Object-oriented programming**   * apply, using pseudocode and programming language, object-oriented programming concepts, including:   + classes   + objects   + attributes   + methods/operations   + abstraction   + instantiation   + inheritance * use an object-oriented programming language to:   + create classes and objects with attributes and methods.   + instantiate objects   + use inheritance to extend classes   + use variables and control structures within objects |
| 9–10 | **Ethical and legal implications for developers of software**   * impacts of software in society, including:   + computer malware, such as viruses   + reliance on software   + social networking   + cyber safety   + large volumes of information (which may be unsupported, unverifiable, misleading or incorrect) available through the internet * rights and responsibilities of software developers   + acknowledging the intellectual property of others   + recognition by others of the developer’s intellectual property   + producing quality software solutions   + appropriately responding to user-identified problems   + adhering to code of conduct   + neither generating nor transmitting malware   + addressing ergonomic issues in software design   + ensuring software addresses inclusivity issues   + ensuring individuals’ privacy is not compromised * concepts associated with piracy and copyright law in relation to software development in Australia |  |
| 11–12 | **Networking Communications**  **Models of networking**   * comparison between the Open Systems Interconnection (OSI) Model and the Department of Defence (DoD) transmission control protocol/internet protocol (TCP/IP) model * OSI model:   + purpose of OSI model   + layers of OSI model   + role of layers within the model   + MAC address layer 2 switching   + IP address layer 3 routing * DoD TCP/IP model:   + purpose of DoD model   + layers of DoD model     - application     - transport     - internet     - network   + role of layers within the model * key protocols and devices associated with layers in models   + user datagram protocol (UDP)   + difference between UDP and TCP   + compare packet architecture between TCP and UDP * features of TCP/IP   + IPv4 vs IPv6   + IP Addressing   + private vs Public IP addressing   + subnet masks   + subnetting   + default gateways   + domain name system (DNS)   + ports   + packet architecture     - data     - segment     - packet     - frame     - bits | **Models of networking**   * identify, design and apply IP addressing scheme * identify, design and apply subnet masks |
| 13–14 | **Network components**   * role of components at different network layers   + transmission media   + router   + gateway   + switch   + wireless Access Point   + firewalls   **Network performance**   * network design topology for security and performance * bandwidth   + mapping networks using diagrams including intermediary and end devices   + subnetting and collision domains (segmentation) * tools for network performance management and troubleshooting   + ping   + traceroute | **Network performance**   * use ping and traceroute to troubleshoot and evaluate network performance * interpret and create network diagrams using specified CISCO conventions to represent network topologies, considering addressing, subnets, segmentation, security and performance |
| 15 | Revision | |
| 16 | Semester 1 Examination | |

## Unit 4: Design and development of database solutions and cyber security considerations

| **Week** | **Syllabus Content** | |
| --- | --- | --- |
| **Knowledge** | **Skills** |
| 1–2 | **Course introduction**   * review of Unit 3 * overview of Unit 4 * assessment requirements   **Cyber Security**  **Network threats**   * external Network Threats   + social engineering (phishing)   + denial of service, including distributed denial of service   + back door   + IP spoofing   + SQL Injection   + man-in-the-middle   + cross-site scripting   + types of malware   + physical network threats   + zero day vulnerabilities * internal network threats   + lost or stolen devices   + compromised credentials   + misuse by employees * security solutions to network threats   + analysis of log files   + anti-malware   + firewall filtering   + access control lists   + intrusion prevention systems   + virtual private networks   + user training   + ICT code of conduct   + physical security * appropriate solutions to different external network threats | **Network threats**   * identify network security threats and suggest solutions for a given stimulus (mitigation strategies) |
| 3 | **Cryptography**   * symmetric encryption * asymmetric encryption (public/private keys)   + certificate purpose and use * use of asymmetric encryption to:   + prevent unauthorised access to data   + authenticate data being sent across network * secure communication over the Internet:   + use of asymmetric encryption to establish connection and symmetric encryption to exchange data * common methods of encryption:   + early methods and weaknesses   + current best practice   **Ethics and Law**   * the *Privacy Act 1988* as it relates to data security Australian Privacy Principle 11 (APP11) * the *Privacy Amendment (Notifiable Data Breaches) Act 2017* | **Ethics and Law**   * apply theoretical ethics and law knowledge using supplied case studies |
| 4–5 | **Ethical Hacking**   * role of ethical hacking in improving network security * penetration testing: role of blue team vs red team   **Data Management**  **Core concepts**   * organisation of a relational database:   + entities   + attributes   + relationships:     - one-to-one     - one-to-many     - many-to-many   + tables as the implementation of entities, consisting of fields and records   + data types     - integer     - float     - Boolean     - text     - date * primary and foreign keys to link tables * composite key * data anomalies:   + insert   + update   + delete * how databases interact with other systems and link to the programming content   + open database connectivity * role of ACID in database transactions – atomicity, consistency, isolation, durability |  |
| 6–8 | **Data modelling**   * purpose of database documentation for the developers   + data dictionary   + Entity Relationship (ER) diagrams using crow’s foot notation   **Data integrity**   * data integrity:   + referential integrity   + domain integrity   + entity integrity * factors influencing quality of data, including:   + currency   + authenticity   + relevance   + accuracy   + outliers (cleaning) | **Data modelling**   * analyse ER diagrams written in crow’s foot notation (three to 10 tables) * create accurate ER diagrams using crow’s foot notation (three to eight tables) * represent databases using relational notation) * create data dictionaries * resolve many-to-many (M:N) relationships |
| 9–10 | **Normalisation**   * purpose of normalising data to third normal form (3NF)   + rules of 1NF   + rules of 2NF   + rules of 3NF * know the process to normalise data to 3NF | **Normalisation**   * apply the process to normalise data to 3NF using relational notation |
| 11–13 | **Database creation and manipulation**   * know techniques to retrieve required information through querying data sets, including:   + searching, sorting and filtering to identify relationships and patterns   + cleaning and manipulating data sets to import required data into a database | **Database creation and manipulation**   * use a relational database management system (RDBMS) to create and manipulate a relational database with a minimum of five tables. * use SQL to create, modify and manipulate a database including:   + CREATE and MODIFY tables, including:     - use of constraints to ensure validity of data     - enforcing referential integrity   + DROP   + SELECT   + INSERT   + UPDATE   + DELETE, including cascading deletes   + aggregate functions (COUNT, SUM, AVG, MAX, MIN)   + ORDER BY   + inner join across multiple tables (up to 4 tables)   + GROUP BY (with aggregate functions)   + calculated fields   + concatenated fields   + use of aliases with calculated and concatenated fields * apply techniques to retrieve required information through querying data sets, including:   + searching, sorting and filtering to identify relationships and patterns   + cleaning and manipulating data sets to import required data into a database |
| 14 | **Development issues**   * ethical issues:   + collecting data about individuals   + privacy concerns   + appropriate use of data   + reliability of data sources   + acknowledgement of data sources   + use of data mining * security issues:   + keeping personal data private   + backups of organisational data   + restricting access to data   + ownership and control of data * legal issues   + Australian privacy law in relation to database development   + Australian Privacy Principles (APP5, APP8, APP10, APP11, APP12) |  |
| 15 | Revision |  |
| 16 | Semester 2 Examination |  |