Government of **Western Australia**
**School Curriculum and Standards Authority**

# SAMPLE COURSE OUTLINE

## COMPUTER SCIENCE
## ATAR YEAR 12

# Sample course outline

# Computer Science – ATAR Year 12

## Unit 3: Design and development of computer-based systems and database solutions

| Week | Syllabus Content | |
|---|---|---|
| | Knowledge | Skills |
| 1 | **Course introduction**<br>• overview of Unit 3<br>• assessment requirements<br>**Systems analysis and development**<br>• types of system development methodologies<br>  ▪ linear – waterfall/cascade<br>  ▪ iterative – rapid application development (RAD)<br>  ▪ advantages and disadvantages of linear and iterative system development methodologies | |
| 2 | **Systems analysis and development**<br>• stages of the system development life cycle (SDLC)<br>  ▪ preliminary analysis<br>  ○ problem definition<br>  ○ feasibility study<br>  ▪ analysis<br>  ○ model of current system<br>  ○ requirements of new system<br>  ▪ design<br>  ○ logical and physical design<br>  ▪ development<br>  ○ hardware and software acquisition<br>  ○ construction and testing<br>  ▪ implementation<br>  ○ change-over methods, including: direct cut, phased, pilot and parallel<br>  ▪ evaluation and maintenance<br>  ○ performance evaluation<br>  ○ fault finding and correction<br>• data gathering techniques used in the SDLC, including: observation, questionnaire, interview, sample forms, and sampling volume of work processed by system | |
| 3–4 | **Systems analysis and development**<br>• project management computer aided software engineering (CASE) tools<br>  ▪ Gantt charts<br>  ▪ program evaluation review technique (PERT) charts<br>• systems development documentation as a part of the SDLC<br>  ▪ context diagrams using Yourdon/DeMarco notation | **Systems analysis and development**<br>• apply data gathering techniques and CASE tools<br>• analyse user and system documentation, including: Gantt charts, PERT charts, context and data flow diagrams<br>• create user and system documentation as a part of the SDLC<br>• apply context diagrams and data flow diagrams, using Yourdon/DeMarco notation, as a part of the SDLC |

| Week | Syllabus Content | |
|---|---|---|
| | **Knowledge** | **Skills** |
| | ▪ data flow diagrams using Yourdon/DeMarco notation<br>▪ system manuals<br>▪ user manuals | ▪ detect errors in diagrams<br>▪ define system boundaries<br>▪ create accurate diagrams<br>▪ create context diagrams<br>▪ create Level 0 DFDs<br>▪ create Level 1 DFDs |
| 5–7 | **Systems analysis and development**<br>• appropriate hardware components for a computer system designed for a specific purpose<br>• purpose of a standard operating environment (SOE)<br>• advantages and disadvantages of a SOE<br>• roles of an operating system<br>▪ scheduling<br>▪ managing concurrency<br>▪ managing memory<br>▪ managing devices<br>• role of file systems<br>• features of file systems, including:<br>▪ space management<br>▪ filenames<br>▪ directories<br>• role of drivers<br>• types of operating systems<br>▪ embedded<br>▪ stand alone<br>▪ server<br>• role of the following components of the central processing unit (CPU)<br>▪ arithmetic logic unit (ALU)<br>▪ control unit (CU)<br>▪ registers<br>▪ program counter<br>▪ system clock<br>▪ data, address and control bus<br>• purpose of the fetch-execute cycle<br>• stages of the fetch-execute cycle<br>▪ fetch<br>▪ decode<br>▪ execute<br>▪ store<br>• purpose of processor architectures for different types of systems<br>• types of processing<br>▪ distributed<br>▪ sequential<br>▪ parallel<br>▪ multi-core<br>• purpose of using benchmarking to determine system performance:<br>▪ software | |

| Week | Syllabus Content | |
|---|---|---|
| | **Knowledge** | **Skills** |
| | ▪ hardware<br>▪ operating systems<br>• purpose of disaster recovery plans<br>• types of disaster recovery tools, including:<br>▪ online storage<br>▪ incremental backup<br>▪ full backup<br>▪ RAID (Level 0, 1, 10)<br>▪ uninterruptible power supply (UPS)<br>• benefits of virtualisation<br>• types of platform virtualisation<br>▪ desktop virtualisation<br>▪ personal computer virtualisation<br>▪ server virtualisation<br>▪ storage virtualisation<br>• purpose of platform virtualisation with application virtualisation<br>• purpose of cloud computing<br>• advantages and disadvantages of cloud computing<br>• convergence of technologies, including the continued development of mobile devices<br>• environmental issues related to the disposal of computer components<br>• methods for the secure disposal of data, including:<br>▪ physical destruction of media<br>▪ overwriting<br>• purpose of intellectual property in the development of ICT systems<br>• role of law and ethics in the use of ICT systems, including:<br>▪ use of code of conduct policies<br>▪ prevention of software and information piracy | |
| 8–9 | **Managing data**<br>• types of physical storage of databases<br>▪ online<br>▪ local<br>• types of databases<br>▪ distributed<br>▪ centralised<br>• structure of data warehouses and data marts<br>• role of data mining<br>• compare data warehouses and data marts as methods of data storage and distribution<br>• ethical implications of the use of data warehouses, data marts and data mining<br>• purpose of a data dictionary | |

| Week | Syllabus Content | |
|---|---|---|
| | **Knowledge** | **Skills** |
| | • elements of a data dictionary, including: element name, data type, size/format default, description, constraint | |
| 10 | **Managing data**<br>• database management system concepts, including:<br>▪ data definition<br>▪ data duplication<br>▪ data integrity, including: referential integrity, domain integrity and entity integrity<br>▪ data redundancy<br>▪ data anomalies, including: insert, delete and update<br>▪ data manipulation<br>▪ data security<br>• normalisation of data to 3rd normal form (NF) | **Managing data**<br>• normalise data to 3rd NF |
| 11–14 | **Managing data**<br>• role of open systems in:<br>▪ database interconnectivity<br>▪ database development<br>▪ database management<br>▪ data driven websites<br>• data modelling using Chen's notation entity relationship (ER) diagrams<br>• purpose of database documentation for the user<br>• role of law and ethics in the storage and disposal of personal data, including: the impact of privacy laws in Australia on the storage and distribution of data<br>• design considerations for visual interfaces and navigation systems within database systems, including:<br>▪ readability<br>▪ navigation<br>▪ logical order<br>▪ inclusivity | **Managing data**<br>• analyse existing ER diagrams<br>• create accurate ER diagrams<br>• create a model of a database solution using Chen's notation entity relationship (ER) diagrams<br>• create data dictionaries<br>• create visual interface and navigation systems to assist users of a database<br>• create database documentation for the user<br>• normalise data to 3rd NF<br>• resolve complex many-to-many (M:N) relationships in a multi-table relational database system<br>(three or more entities)<br>• create a working relational multi-table database using:<br>▪ data types<br>▪ relations<br>▪ primary, composite and foreign keys<br>▪ referential integrity<br>▪ relationships, including: set cascade inserts, updates and deletes<br>▪ cardinality (1:1, 1:M, M:1, M:N)<br>▪ validation rules<br>▪ forms<br>▪ reports<br>▪ simple queries using SQL (up to two tables), including: insert, update and select queries<br>▪ queries across multiple tables using appropriate database tools, including the following: parameter, calculated field, |

| Week | Syllabus Content | |
|---|---|---|
| | Knowledge | Skills |
| | | concatenated field, aggregation, update, delete and make table<br>• apply simple programmed control structures, including IF statements and calculations within the database |
| 15 | Revision | |
| 16 | Semester 1 Examination | |

## Unit 4: Design and development of communication systems and software solutions

| Week | Syllabus Content | |
|---|---|---|
| | Knowledge | Skills |
| 1 | **Course introduction**<br>• review of Unit 3<br>• overview of Unit 4<br>• assessment requirements<br>**Developing software**<br>• types of software licence requirements, including:<br>  ▪ network (per seat)<br>  ▪ enterprise<br>  ▪ commercial/proprietary<br>  ▪ end user licence agreement (EULA)<br>• factors affecting the development of software, including:<br>  ▪ user needs<br>  ▪ user interface<br>  ▪ processing efficiency<br>  ▪ development time<br>  ▪ technical specifications<br>• professional ethics of developers when creating new software | |
| 2 | **Developing software**<br>• legal obligations of developers when creating new software<br>• legal and ethical responsibilities of software users<br>• stages of the software development cycle (SDC)<br>  ▪ analyse detailed requirements<br>  ▪ design data and algorithms<br>  ▪ code data structures and instructions<br>  ▪ debug syntax and logic errors<br>  ▪ test to meet specifications<br>  ▪ document internally and externally<br>  ▪ implement and test with live data<br>  ▪ evaluate performance of the program | **Developing software**<br>• apply the SDC in planning and developing software solutions |

| Week | Syllabus Content | |
|---|---|---|
| | Knowledge | Skills |
| 3–6 | **Programming**<br>• characteristics of simple data types:<br>  ▪ integer<br>  ▪ real (floating point number)<br>  ▪ Boolean<br>  ▪ character<br>• characteristics of complex data types:<br>  ▪ string<br>  ▪ one-dimensional arrays<br>  ▪ records<br>• programming concepts, including:<br>  ▪ constants<br>  ▪ variables (local, global, parameters)<br>  ▪ appropriate naming conventions for variables<br>  ▪ control structures<br>  ▪ stubs<br>  ▪ statements<br>  ▪ modularisation<br>  ▪ functions<br>  ▪ scope and lifetime of identifiers, including: parameter passing (value and reference)<br>• difference between source code, byte code and executable code<br>• difference between an interpreter and a compiler<br>• types of program or code errors, including:<br>  ▪ syntax errors<br>  ▪ run-time errors<br>  ▪ logical errors<br>• purpose and characteristics of internal and external documentation<br>• software development documentation as a part of the SDC<br>  ▪ structure charts using the Yourdon and Constantine method<br>• modelling of an algorithm using trace tables to test for logic<br>• types of data validation techniques, including:<br>  ▪ range checking<br>  ▪ type checking | **Programming**<br>• use pseudocode to represent a programming solution<br>• apply, using pseudocode and a programming language, the following programming concepts:<br>  ▪ constants<br>  ▪ variables (local, global, parameters)<br>  ▪ naming conventions for variables<br>  ▪ stubs<br>  ▪ statements<br>  ▪ modularisation<br>  ▪ functions<br>  ▪ parameter passing (value and reference)<br>  ▪ one-dimensional arrays<br>• apply, using pseudocode and a programming language, the following control structures:<br>  ▪ sequence<br>  ▪ selection<br>  ○ one-way (if then)<br>  ○ two-way (if then else)<br>  ○ multi-way (case, nested if)<br>  ▪ iteration<br>  ○ test first (while)<br>  ○ test last (repeat until)<br>  ○ fixed (for)<br>• resolve program and code errors<br>• apply the following algorithmic and programming techniques:<br>  ▪ develop internal and external documentation<br>  ▪ interpret and create structure charts with parameter passing<br>  ▪ select and apply suitable test data and testing techniques<br>  ○ use trace tables to test for and debug logic errors<br>  ○ use data validation techniques, including: range checking and type checking |
| 7–10 | | **Programming**<br>• apply the SDC to create prototype digital solutions using pseudocode and an appropriate programming language |

| Week | Syllabus Content | |
|---|---|---|
| | Knowledge | Skills |
| 11–12 | **Networks and communications**<br>• role of the following hardware devices in network communications:<br>▪ router<br>▪ switch<br>▪ firewall<br>▪ modem<br>▪ network interface card (NIC)<br>▪ wireless access point<br>▪ bridge<br>▪ gateway<br>▪ repeaters<br>• role of the layers within the Department of Defence (DoD) transmission control protocol/internet protocol (TCP/IP) model in network communications<br>• purpose of the layers within the DoD TCP/IP model, including:<br>▪ application layer<br>▪ transport layer<br>▪ internet layer<br>▪ network layer<br>• characteristics of wireless transmission media, including:<br>▪ broadcast radio<br>▪ satellite<br>▪ microwave<br>▪ cellular<br>• characteristics of wired transmission media, including:<br>▪ twisted pair (unshielded twisted pair [UTP] and shielded twisted pair [STP])<br>▪ fibre optic (single-mode, multi-mode)<br>• similarities and differences of the carrier sense multiple access with collision detection (CSMA/CD) and the carrier sense multiple access with collision avoidance (CSMA/CA) network control protocols | |

| Week | Syllabus Content | |
|---|---|---|
| | Knowledge | Skills |
| 13–14 | **Networks and communications**<br>• methods of error detection and correction in digital data transmission, including:<br>▪ parity bit<br>▪ checksum<br>• types of communications protocols and standards, including:<br>▪ wireless (Bluetooth, ethernet 802.11x, radio frequency identification [RFID])<br>▪ wired (ethernet 802.3)<br>▪ TCP/IP (IP4, IP6)<br>• dynamic host configuration protocol (DHCP) and domain name service (DNS)<br>• role of storage area networks (SAN) and network attached storage (NAS)<br>• similarities and differences of SAN and NAS<br>• methods used to ensure the security of networks, including use of:<br>▪ firewalls<br>▪ anti-virus software<br>▪ password and network user policies<br>▪ authentication<br>▪ encryption<br>• strategies used to compromise the security of networks, including:<br>▪ denial of service<br>▪ back doors<br>▪ IP spoofing<br>▪ phishing<br>• factors influencing the performance of a network, including:<br>▪ bandwidth<br>▪ network design<br>▪ data collisions<br>▪ excess broadcast traffic | **Networks and communications**<br>• create network diagrams using the CISCO network diagrammatic conventions to represent network topologies for LAN, WLAN and WAN |
| 15 | Revision | |
| 16 | Semester 2 Examination | |