**Sample Course Outline**

Computer Science

ATAR Year 11

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Sample course outline

Computer Science – ATAR Year 11

Semester 1 – Unit 1 (Design and development of programming and network solutions)

| **Week** | **Syllabus Content** |
| --- | --- |
| **Knowledge** | **Skills** |
| 1–3 | Introduction* overview of Semester 1
* assessment requirements

Programming*Programming skills and concepts** characters represented as numbers in binary, decimal and hexadecimal
* program control structures
	+ sequence
	+ selection
	+ iteration
* modular coding using functions, parameters and arguments
	+ scope of variables (Global, Local)
* data types used in solutions, including:
	+ integer
	+ float
	+ string
	+ Boolean
* types of operators:
	+ arithmetic operators (+, -, \*, /, % or MOD)
	+ relational operators (==, !=, >, <, >=, <=)
	+ logical operators (AND, OR, NOT)
 | Programming*Programming skills and concepts** apply, using pseudocode and a programming language, the following program control structures
	+ sequence
	+ selection
	+ iteration
* use modular coding using functions, parameters and arguments
	+ scope of variables (Global, Local)
* apply, using pseudocode and a programming language, data types used in solutions, including:
	+ integer
	+ float
	+ string
	+ Boolean
* use different types of operators:
	+ arithmetic operators (+, -, \*, /, %)
	+ relational operators (==, !=, >, <, >=, <=)
	+ logical operators (AND, OR, NOT)
 |
| 4 | * identify the characteristics of the following data structures:
	+ one-dimensional array
 | * read and write complex logical expressions including Boolean operators
	+ AND, OR, NOT
	+ logical order of precedence
* apply, using pseudocode and a programming language the following data structures:
	+ one-dimensional array
 |
| 5–6 | *Good programming practice** Framework for development
	+ investigate
		- problem description
		- define requirements
		- development schedule
	+ 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
* good programming practice, including:
	+ validate input before processing
	+ use of meaningful variable names
	+ use constants for readability and maintenance
	+ use of comments to explain code
	+ appropriate use of standard control structures
	+ use of appropriate indentation and white space
	+ one logical task per module
	+ meaningful names for modules
	+ exception handling
 | *Good programming practice** apply the framework for development
* apply good programming practice, including:
	+ validate input before processing
	+ use of meaningful variable names
	+ use constants for readability and maintenance
	+ use of comments to explain code
	+ appropriate use of standard control structures
	+ use of appropriate indentation and white space
	+ one logical task per module
	+ meaningful names for modules
	+ exception handling
 |
| 7–8 | *Structured algorithms** benefits of using structured algorithms
	+ ease of development
	+ ease of understanding
	+ ease of modification
* using pseudocode for representing algorithms
* efficient algorithm design
	+ use of a modular approach
	+ structure charts as a design tool
	+ use of stubs to represent incomplete modules
 | *Structured algorithms** using pseudocode to represent algorithms
	+ design efficient algorithms
	+ use of a modular approach
	+ structure charts as a design tool
	+ use of stubs to represent incomplete modules
* use of standard algorithms
	+ processing of arrays, including:
		- load an array and print its contents
		- add the contents of an array of numbers
		- identify position of minimum or maximum value
	+ processing of sequential text files, including:
		- open for read, write and append
		- read and process data
		- write and append content
		- close
 |
| 9–10 | *Testing** appropriate test data, including:
	+ data that test all the pathways through the algorithm
	+ data that test boundary conditions ‘at’, ‘above’ and ‘below’ values upon which decisions are based
	+ data where the required answer is known
	+ type and range checking

*Error detection and debugging code** type of coding errors, including:
* syntax error
* runtime errors
* logic errors

*Ethical and legal implications of software development** concepts associated with piracy and copyright, including:
	+ intellectual property
		- plagiarism in relation to the acknowledgement of code
		- Australian copyright laws
	+ software licensing (as per syllabus support document)

*External modules** API (application programming interface)
	+ purpose of an API
	+ use of an API when developing software
 | *Testing** identify and select appropriate data to test an algorithm, including:
	+ data that tests all the pathways through the algorithm
	+ data that tests boundary conditions ‘at’, ‘above’ and ‘below’ values upon which decisions are based
	+ data where the required answer is known
	+ type and range checking
* testing both algorithms and coded solutions with test data, such as:
	+ desk checking an algorithm (trace table)
	+ stepping through a coded solution

*Error detection and debugging code** debugging output statements
	+ additional print statements in the code for use in the debugging process
		- used to identify which sections of the code have been executed
		- used to interrogate variable contents at a particular point in the execution of a program
 |
| 11–12 | Network Communications*Models of Networking** purpose of Department of Defense Transmission Control Protocol/Internet Protocol (DoD TCP/IP model)
* layers of DoDTCP/IP model
	+ application
	+ transport
	+ internet
	+ network
* role of layers within the model
* key protocols associated with layers
* role of IP addresses
* role of subnet masks
* key differences between IPv4 vs IPv6

*Network components** the function of networking components at different layers of TCP/IP model
	+ transmission media (UTP, fibre optics, wireless)
	+ router
	+ switch
	+ wireless access point
	+ firewall

*Network security** need for preventing unauthorised access to a network
* role of firewalls in securing networks
* role of operating systems in network security
 |  |
| 13–14 | *Network performance** factors that affect network performance:
	+ bandwidth
	+ network design
	+ data collisions
	+ excess broadcast traffic
 | *Network performance** create network diagrams using the CISCO network diagrammatic conventions to represent network topologies for LAN, WLAN and WAN
 |
| 15 | Revision |
| 16 | Semester 1 examination |

Semester 2 – Unit 2 (Design and development of database solutions and cyber security considerations)

| **Week** | **Syllabus Content** |
| --- | --- |
| **Knowledge** | **Skills** |
| 1–2 | Course review* review Unit 1
* review assessment requirements
* overview of Semester 2

Cyber security*Ethics and Law** role of ethical hacking in network security
	+ purpose (improving security)
	+ penetration testing
	+ comparison with unethical hacking
* role of the *Privacy Act 1988*
* the concept of the Australian privacy principles
* Australian Privacy Principles in relational to keeping data secure

*Network security** authentication
	+ characteristics of strong passwords
	+ organisational approach to password policies
	+ password policies impact on data security
	+ two-factor authentication
	+ biometrics
* encryption
	+ purpose of encryption
	+ public vs private key encryption
 |  |
| 3–4 | *Network Threats** distinguish between the different methods used to compromise the security of a system:
	+ social engineering (phishing)
	+ denial of service
	+ back door
	+ IP spoofing
	+ SQL injection
	+ man-in-the-middle
	+ cross site scripting
	+ types of malware(as per syllabus support document)
	+ physical security threats
	+ zero day vulnerabilities

*Cryptography** purpose of cryptography
* plain text vs cipher text
* common ciphers:
	+ substitution:
		- rotation cipher
		- random substitution
		- polyalphabetic cipher (e.g. Vigenère)
	+ methods for cracking substitution ciphers:
		- brute force
		- frequency analysis
 | *Cryptography** use common ciphers
 |
| 5–8 | **Data management***Database management system (DBMS)** relationship between data and information
* flat file vs relational database
* relational database managements system (RDBMS):
	+ role of a RDBMS in handling access to data
	+ independence of data from RDBMS

*Core database 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
	+ hierarchical structure of data
		- field/attribute
		- record
		- table/entity
	+ datatypes
		- integer
		- float
		- Boolean
		- text
		- date
* primary and foreign keys to link tables
* composite key
* data anomalies:
	+ insert
	+ update
	+ delete

*Data modelling** purpose of database documentation for developers:
	+ data dictionary
	+ entity relationship (ER) diagrams using crow’s foot notation (see support document)

*Data integrity** factors influencing integrity of data, including:
	+ currency
	+ authenticity
	+ relevance
	+ accuracy
	+ outliers (cleaning)
* relationship between validity and accuracy of data
 | *Data modelling** analyse ER diagrams written in crow’s foot notation (3 to 6 tables)
* create accurate ER diagrams (3 to 4 tables) using crow’s foot notation
* create a data dictionary (see support document)
* resolve many to many (M:N) relationship
 |
| 9–11 | *Normalisation** purpose of normalising data to third normal form (3NF)
* know the process to normalise data to 3NF
 | *Normalisation** apply the process to normalise data to 3NF (3-4 tables)
	+ normalise data to 1NF
	+ normalise data to 2NF
	+ normalise data to 3NF
 |
| 12–13 |  | *Database creation and manipulation** use a RDBMS to create and manipulate a relational database with a minimum of 3 tables.
* use SQL to manipulate a database including:
	+ SELECT
	+ INSERT
	+ DELETE
	+ UPDATE
	+ ORDER BY
	+ inner join across two tables
	+ aggregate functions (COUNT, SUM, AVG, MAX, MIN)
 |
| 14 | *Development issues** Ethical issues
	+ collecting data about individuals
	+ privacy concerns
	+ appropriate use of data
	+ Australian Privacy Principles applicable to the use of personally identifiable and sensitive data
* Security issues
	+ keeping personal data private
	+ backups of organisational data
	+ restricting access to data
* Legal issues
	+ implications of the *Privacy Act 1988* for developers
 |  |
| 15 | Revision |
| 16 | Semester 2 examination |