## Higher Computing Science Existing Scholar materials for CPD/adaption

The following list shows how some of the existing Scholar materials can be mapped to the new higher course. Whilst Scholar are working on a new course to support H Computing Science, practitioners aiming to deliver the course may find these existing resources useful for professional learning or adapting for delivery in the classroom.

Scholar can be accessed at <u>http://scholar.hw.ac.uk</u>. Practitioners can access the resources in online and PDF format using the school's CPD account if they are not currently delivering the courses listed. This can be obtained from your Scholar coordinator.

Items in italics do not have any coverage in the current materials.

Software Design and Development		
Торіс	Detailed Content	Existing Scholar Materials
Languages and environments	Description of the key characteristics of the following language types: Low-level High-level procedural declarative	<ul> <li>procedural: Higher Comp Unit 2, 5.4</li> <li>Declarative: Higher Comp Unit 2, 5.5</li> <li>Object Oriented: AH Comp Unit 1, 3.1 – 3.4</li> <li>HLL: Higher Comp Unit 2, 5.2 – 5.3, AH Comp Unit 1, 3.6.3</li> <li>LLL: AH Comp Unit 1, 3.6.1 – 3.6.2</li> </ul>
Computational Constructs	<ul> <li>parameter passing (value and reference, formal and actual)</li> <li>scope, local and global variables</li> <li>sub-programs/routines, defined by their name and</li> <li>arguments (inputs and outputs), including         <ul> <li>functions</li> <li>procedures</li> <li>methods</li> </ul> </li> </ul>	<ul> <li>Sub Programs &amp; Functions: Higher Comp Unit 2, 8.1 - 8.3</li> <li>Parameter Passing: Higher Comp Unit 2, 8.2</li> <li>Scope: Higher Comp Unit 2, 6.9</li> <li>Functions: Higher Comp Unit 2, 8.3</li> <li>Procedures: Higher Comp Unit 2, 8.2</li> </ul>
Data Types and structures	<ul> <li>String</li> <li>Numeric (integer and real) variables</li> <li>Boolean variables</li> <li>1D arrays, records</li> <li>Sequential files (open, create, read, write, close)</li> </ul>	<ul> <li>Data Types: Higher Comp Unit 2, 6.5 + 6.6</li> <li>1D Arrays: Higher Comp Unit 2, 7.8</li> <li>Records: AH Comp Unit 1, 6.6 - 6.7</li> <li>Sequential Files: AH Comp Unit 1, 5.1</li> </ul>

Testing and documenting solutions	<ul> <li>Constructing a test plan</li> <li>Comprehensive testing</li> <li>Syntax, execution and logic errors</li> <li>Dry runs, trace tables/tools, break points</li> </ul>	<ul> <li>Test Plan: Higher Comp Unit 2, 2.6. AH Comp Unit 1, 4.1</li> <li>Errors: Higher Comp Unit 2, 3.5 (n.b. execution errors are called run-time errors in this)</li> <li>Dry runs, Trace Tables, Break Points: AH Comp Unit 1, 4.2</li> </ul>
Algorithm specification	<ul> <li>Analysis, exemplification and implementation of algorithms including: <ul> <li>Input validation</li> <li>Linear search</li> <li>Finding minimum and maximum</li> <li>Count occurrences</li> </ul> </li> <li>Analysis of other algorithms of similar complexity</li> </ul>	Higher Comp Unit 2, 8.5
Low-level operations and computer architecture	<ul> <li>Virtual machines</li> <li>Emulators</li> <li>Mobile devices</li> <li>Use of binary to represent and store: <ul> <li>Integers and real numbers</li> <li>Characters</li> <li>Instructions (machine code)</li> <li>Graphics (bit-mapped and vector)</li> <li>Sound</li> <li>Video</li> </ul> </li> <li>Computer Architecture (trends and implications): <ul> <li>Processor (registers, ALU, Control Unit), cache, memory, buses (data and address), interfaces</li> </ul> </li> </ul>	<ul> <li>Integers &amp; real numbers: Higher Comp Unit 1, 1.2. AH Comp Unit 3b, 1.6 - 1.7</li> <li>Characters: Higher Comp Unit 1, 1.3</li> <li>Instructions: AH Comp Unit 3b, 3.3</li> <li>Graphics: Higher Comp Unit 1, 1.4. Higher Comp Unit 3c, 2.1 - 2.5 + 5.4. Higher Info Sys Unit 3b, 3.2.2 + 4.2.1</li> <li>Sound: Higher Comp Unit 3c, 3.1 - 3.6. Higher Info Sys Unit 3b, 4.2.2</li> <li>Video: Higher Comp Unit 3c, 4.1 - 4.6. Higher Info Sys Unit 3b, 4.2.3</li> <li>Computer Architecture: Higher Comp Unit 1, 2.2 - 2.5. AH Comp Unit 3b, 1.3 - 1.4 + 2.3.</li> <li>Trends and implications: some coverage in H Comp Unit 1, 3.3. Useful background in AH Comp Unit 3b, 2.4, 5.1-5.3 - 5.5</li> </ul>

Software and Information System Design and Development		
Торіс	Detailed Content	Existing Scholar Materials
Design notations	<ul> <li>Structure diagram</li> <li>Entity Relationship diagram</li> <li>Data dictionary</li> <li>Pseudocode</li> <li>Wire-framing<sup>2</sup></li> <li>Other contemporary design notations</li> </ul>	<ul> <li>Str. Diag., Pseudocode: Higher Comp Unit 2, 3.2</li> <li>Entity Relationship diagram: Higher Info Sys Unit 2, 1.5</li> <li>Data dictionary: Higher Info Sys Unit 2, 2.6.1. AH Info Sys Unit 1, 5.2 – 5.3</li> <li>Other contemporary design notations: UML is discussed in AH Comp Unit 1, 4.3</li> <li><sup>2</sup> – While not explicitly considered, some of the prototyping content from AH Info Sys Unit 3a, 5.4 is useful background to this</li> </ul>
Development methodologies	Iterative phases of development process: analysis, design, implementation, testing, documentation, evaluation, maintenance. Development methodologies: Rapid application development Top-down/step-wise refinement Agile methodologies	<ul> <li>Development Process: Higher Comp Unit 2, 2.1 – 2.10</li> <li>Top-down/step-wise: Higher Comp Unit 2, 3.2</li> <li>RAD: some coverage of CASE tools in AH Comp Unit 1, 4.3. AH Info Sys Unit 3a, 5.4 (prototyping).</li> </ul>
Contemporary developments	<ul> <li>Exemplification of trends in the development of:</li> <li>Software development languages</li> <li>Software development environments</li> <li>Intelligent systems</li> <li>Online systems</li> </ul>	<ul> <li>Software development languages: AH Comp Unit 1, 3.6</li> <li>Intelligent Systems: Higher Comp Unit 3a, 3.2 – 3.5, 4.1 – 4.2, 5.2 – 5.6</li> <li>Online Systems: Higher Comp Unit 3b, 4.3.2 (dated), Higher Info Sys Unit 3c, 7.3 – 7.6, AH Info Sys Unit 3b, 2.1 – 2.7</li> </ul>
User Interface	<ul> <li>Usability</li> <li>accessibility</li> </ul>	Usability: AH Info Sys Unit 3a, 7.2

Information Systems Design and Development		
Торіс	Detailed Content	Existing Scholar Materials
Structures and links (Database)	<ul> <li>Database structures: relational</li> <li>Primary keys, including compound keys</li> <li>Relationships (one-to-one, one-to-many, many-to-many)</li> <li>Complex database operations (including queries, forms, reports, calculating)</li> </ul>	<ul> <li>Relational: Higher Info Sys Unit 2, 1.5, 2.1 – 2.6, 3.1 – 3.3</li> <li>Primary Keys: Higher Info Sys Unit 2, 2.5</li> <li>Relationships: Higher Info Sys Unit 2, 1.5</li> <li>Complex database operations: AH Info Sys Unit 2, 4.1 (limited)</li> </ul>
Structures and links (Web- based)	<ul> <li>Site Structure: Multi-level</li> <li>Page structure: including head, title, body</li> <li>Cascading Style Sheets</li> <li>Meta tags</li> <li>Dynamic web pages, database-driven website</li> <li>Interactive web page<sup>3</sup></li> </ul>	<ul> <li>Multi-level: Higher Info Sys Unit 3b, 2.1</li> <li>Page Structure: Higher Comp Unit 3b 4.1 + 4.2. Higher Info Sys Unit 3c, 4.2 – 4.4. AH Comp Unit 3c 3.4</li> <li>Cascading style sheets: Higher Info Sys Unit 3c, 6.4. AH Comp Unit 3c 3.4.</li> <li>Meta tags: Higher Info Sys Unit 3c, 4.4.4</li> <li>Dynamic Web Pages: Higher Info Sys Unit 3c, 6.3.2 (brief), 7.3.</li> <li>Database-driven website: AH Info Sys Unit 3b, 5.1 – 5.4 (practical example), 6.1 – 6.5, 7.1 – 7.5</li> <li><sup>3</sup> - Interactive Web Page: combination of dynamic web page &amp; client-side scripting techniques</li> </ul>
Media types	Compression: • Lossy and lossless techniques, applied to o sound, o Graphics o videos	<ul> <li>Higher Comp Unit 3c, 2.3 (bitmap graphics)</li> <li>Higher Comp Unit 3c, 3.3 (mp3 sound)</li> <li>Higher Comp Unit 3c, 4.3 (MPEG video)</li> </ul>
Coding	<ul> <li>Exemplification and implementation of coding to create and modify information systems including the use of: <ul> <li>Scripting (database/web pages)</li> <li>Client-side scripting</li> <li>Server-side scripting</li> <li>Optimisation (web search (crawlers) and efficiency of coding)</li> </ul> </li> </ul>	<ul> <li>Overview: Higher Info Sys Unit 3c, 5.5, 7.3. AH Comp Unit 3c 3.4.8</li> <li>Server-side: AH Info Sys Unit 3b, 8.1 – 8.2, 9.1 (practical)</li> </ul>

Testing	<ul> <li>Beta testing</li> <li>Usability</li> <li>Compatibility issues (including memory and storage requirements, OS compatibility)</li> </ul>	<ul> <li>Beta testing: Higher Comp Unit 2, 2.6. AH Comp Unit 1, 4.1</li> <li>Usability: H Info Sys Unit 3b, 5.3. AH Info Sys Unit 3a, 7.2</li> <li>Compatibility: Higher Comp Unit 1, 4.3, 7.6</li> </ul>
Purpose, functionality, users	<ul> <li>Detailed description of purpose</li> <li>Interaction of Information Systems with:         <ul> <li>Human users: expert, novice, age-range</li> <li>Other software: search engines</li> </ul> </li> </ul>	<ul> <li>Purpose: Higher Info Sys Unit 3b, 1.3</li> <li>Users (human): AH Info Sys Unit 3a, 4.8</li> <li>Users (machine): Higher Comp Unit 3b, 4.4</li> </ul>
Technical implementation (hardware requirements)	<ul> <li>Input and output devices</li> <li>Processor type, number and speed (Hz)</li> <li>Memory (RAM, ROM, cache)</li> <li>Device types (including, desktop, laptop, tablet, smartphone)</li> </ul>	<ul> <li>Devices: Higher Comp Unit 1, 4.2</li> <li>Processor: Higher Comp Unit 1, 2.4. Higher Comp Unit 3a, 2.7 (parallel processing). AH Comp Unit 3b, 4.3 (RISC/CISC), 5.2 – 5.6 (background / development)</li> <li>Memory: Higher Comp Unit 1, 2.3</li> <li>Device Types: AH Comp Unit 3b, 1.3 (intro), 5.6</li> </ul>
Technical Implementation (software requirements)	<ul> <li>Operating systems</li> <li>Licensing</li> <li>Proprietary versus open source</li> <li>Portability</li> <li>Description and exemplification of current trends in OS design.</li> </ul>	<ul> <li>Operating Systems: Higher Comp Unit 1, 7.2. AH Comp Unit 3b, 6.2</li> <li>Licensing: Higher Comp Unit 1, 6.7.3</li> <li>Proprietary/Open source: AH Comp Unit 3b, 7.5.1 (linux example).</li> <li>Portability: Higher Info Sys Unit 1, 4.7 (portability, compatibility, data migration).</li> <li>Trends in OS design: some limited coverage in AH Comp Unit 3b, 7.2.4</li> </ul>
Technical implementation (storage)	<ul> <li>distributed and off-line storage</li> <li>backup systems and strategy</li> <li>capacity (in appropriate units)</li> <li>rewritable, read-only</li> <li>interface type</li> <li>data transfer speed</li> <li>Storage devices: <ul> <li>built-in, external</li> <li>magnetic, optical</li> <li>solid state</li> </ul> </li> </ul>	<ul> <li>Storage Devices: Higher Comp Unit 1, 4.4. AH Comp Unit 3b, 1.4.2</li> <li>Interfaces: Higher Comp Unit 1, 4.5</li> <li>Distributed Storage: Higher Info Sys Unit 1, 4.8.1</li> <li>Backup: Higher Info Sys Unit 1, 4.5</li> </ul>

	Description and exemplification of current trends in storage systems	
Technical Implementation (networking/connectivity)	Cloud systems and server provision: • Public, private, hybrid • Cloud-based services • Web hosting Description and exemplification of current trends in networking and connectivity.	• Web Hosting: Higher Info Sys Unit 3c, 1.4 (brief).
Security Risks	<ul> <li>spyware, phishing, keylogging</li> <li>online fraud, identity theft</li> <li>DOS (Denial of Service) attacks</li> </ul>	<ul> <li>Denial of Service attacks: Higher Comp Unit 3b, 7.2</li> <li>Online Fraud: Higher Comp Unit 3b, 5.2.5</li> <li>Keylogging: basic coverage with social engineering in Higher Comp Unit 3b, 6.2.6</li> </ul>
Security Precautions	<ul> <li>Encryption</li> <li>Digital certificates and signatures</li> <li>Server-side validation of online form data</li> <li>Biometrics in industry</li> </ul>	<ul> <li>Encryption: Higher Comp Unit 3b, 6.2.4. AH Comp Unit 3c, 5.3. Higher Info Sys Unit 1, 4.4.5.4. Higher Info Sys Unit 3c, 7.4</li> <li>Digital Certificates: AH Comp Unit 3c, 5.5, Higher Info Sys Unit 3c, 7.5</li> </ul>
Legal implications	<ul> <li>Detailed descriptions and implications of :</li> <li>Computer Misuse Act</li> <li>Copyright Designs and Patents Act (plagiarism)</li> <li>Communication Acts</li> <li>Regulation of Investigatory Powers Act</li> </ul>	<ul> <li>Computer misuse act: Higher Comp Unit 3b, 5.5.3</li> <li>Copyright, designs and patents act: Higher Info Sys Unit 1, 6.4.2, Higher Comp Unit 3b, 5.5</li> <li>Regulation of investigatory powers act: 6.4.35</li> </ul>
Environmental implications	<ul> <li>Lifetime carbon footprint (manufacture, use disposal)</li> <li>Environmental benefits</li> </ul>	
Economic and social impact	<ul> <li>Economic: competitive advantage, global marketplace, business costs, maintainability, scalability</li> <li>Social: censorship and freedom of speech, privacy and encryption, global citizenship, online communities</li> </ul>	<ul> <li>Higher Info Sys Unit 1, 6.3, 6.5. Higher Comp Unit 1, 6.5. Higher Comp Unit 3b, 5.2-5.4</li> </ul>

Unit abbreviations used above are explained below, with reference to SQA titles. Numbers/Letters in the above tables correspond to the numbering system in Scholar's materials.

Higher Comp Unit 1:	Computer Systems (DE2X 12)
Higher Comp Unit 2:	Software Development (DF2Y 12)
Higher Comp Unit 3a:	Artificial Intelligence (DE31 12)
Higher Comp Unit 3b:	Computer Networking (DF30 12)
Higher Comp Unit 3c:	Multimedia Technology (DF32 12)
AH Comp Unit 1:	Software Development (DF2Y 13)
AH Comp Unit 2:	Developing a Software Solution (DM43 13)
AH Comp Unit 3a:	Artificial Intelligence (DF31 13)
AH Comp Unit 3b:	Computer Architecture (DM44 13)
AH Comp Unit 3c:	Computer Networking (DF30 13)
Higher Info Sys Unit 1:	Using Information (DM4C 12)
Higher Info Sys Unit 2:	Relational Database Systems (DM4K 12)
Higher Info Sys Unit 3a:	Expert Systems (DM4H 12)
Higher Info Sys Unit 3b:	Applied Multimedia (DM4D 12)
Higher Info Sys Unit 3c:	The Internet (DM4F 12)
AH Info Sys Unit 1:	Database Analysis and Design (DV4X 13)
, AH Info Sys Unit 2:	Database Implementation and Testing (DV4Y 13)
AH Info Sys Unit 3a:	Information Systems Interfaces (DV51 13)
, AH Info Sys Unit 3b:	On-line Database Systems (DV50 13)
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