UNIT 1: Programming

For use with the Higher National Certificate and Higher National Diploma in Computing

First teaching from September 2017

Issue 1
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**SCHEME OF WORK**

<table>
<thead>
<tr>
<th>Programme Title:</th>
<th>Higher Nationals in Computing</th>
<th>Level:</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>Unit Title:</td>
<td>Programming</td>
<td>Tutor:</td>
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<tr>
<td>Unit Number:</td>
<td>1</td>
<td>Academic Year:</td>
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<table>
<thead>
<tr>
<th>Learning Outcomes (LO)</th>
<th>Assessment 1</th>
<th>Assessment 2</th>
<th>Assessment 3</th>
<th>Assessment 4</th>
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<tbody>
<tr>
<td>Define basic algorithms to carry out an operation and outline the process of programming an application.</td>
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<tr>
<td>Explain the characteristics of procedural, object-orientated and event-driven programming, conduct an analysis of a suitable Integrated Development Environment (IDE).</td>
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<tr>
<td>Implement basic algorithms in code using an IDE.</td>
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<td>Determine the debugging process and explain the importance of a coding standard.</td>
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<tr>
<th>Sessions</th>
<th>Learning Outcome(s)</th>
<th>Session Activities</th>
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</table>
| **Session 1** | LO1 Topic: Introduction to the unit's content and the unit assessment | An introduction to algorithms; what is an algorithm? Defining an algorithm; purpose and structure and the outline of a program.  
Sample activities:  
- Present a series of problems and the steps to solve them via brute force and then with an algorithm, such as searching through records.  
- An overview – programming is:  
  - the analysis of the scenario/problem  
  - defining a specification  
  - identifying input, process and output testing/debugging. |
| **Session 2** | LO1 Topic: Examining algorithms | A look at the most common algorithms and their application.  
Sample activities:  
- Examine a range of algorithms for various purposes including:  
  - sorting algorithms  
  - encryption/decryption.  
- Analysing efficiency: their performance against brute force.  
- Cost of running time, acknowledging hardware performance as a factor. |
| **Session 3** | LO1 & 2 Topic: Implementation of algorithms | A look at the code implementation of common algorithms.  
Sample activities:  
- Examination of the structure of a program: input, process and output.  
- Identifying methods, variables, constants, scope, relating to an algorithm implementation.  
Assignment 1 set. |
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| Session 4 | LO1 & 2<br>Topic: Assignment workshop | Addressing issues and concerns with the assignment. Sample activities:  
• An overview of assessment requirements.  
• Question and answer session regarding assignment. |
| Session 5 | LO2<br>Topic: Introduction to the procedural programming paradigm | Analysing the characteristics of procedural programming. Sample activities:  
• Identify what procedural programming is.  
• Overview of the process of procedural development.  
• Recognise the characteristics.  
• An examination of a program implementation. |
| Session 6 | LO2<br>Topic: Introduction to the object-orientated programming paradigm | Identification of the characteristics of object-orientated programming (OOP). Sample activities:  
• Identify what OOP is.  
• Building on the procedural programming paradigm.  
• Definition of an object. |
| Session 7 | LO2<br>Topic: Identifying characteristics of object-orientated programming | Analysing the characteristics of object-orientated programming. Sample activities:  
• Class definition and its make up.  
• Class and object association. |
| Session 8 | LO2<br>Topic: Object-orientated programming paradigm implementation | Analysing practical implementation of object-orientated programming. Sample activities:  
• An examination of an implementation of a program.  
• Identifying object class relationship.  
• Overview of the process of OOP development. |
| Session 9 | LO2<br>Topic: Introduction to the event driven programming paradigm | Identification of the characteristics of event driven programming. Sample activities:  
• Identify what event driven programming is.  
• Building on the previous programming paradigms. |
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</table>
| Session 10 | LO2 Topic: Identifying characteristics of event driven programming | Analysing the characteristics of event driven programming. Sample activities:  
- Examination of what makes an event driven program.  
- Typical events encountered; timers, input etc.  
- Event listeners, triggers. |
| Session 11 | LO2 Topic: A summary of the programming paradigms | A look at the relationships between the programming paradigms. Sample activities:  
- Discuss the relationship between the programming paradigms, how they complement each other.  
- Review a range of applications that would be best suited for developing in each/or multiple programming paradigms. |
| Session 12 | LO2 & 3 Topic: What is an IDE? | A look at the various components of an IDE, the editor, file manager and compiler. Sample activities:  
- Setup and installation of an IDE.  
- User configuration of an IDE (fonts, shortcuts, etc.). |
| Session 13 | LO2 & 3 Topic: The IDE continued | A look at the debugger, performance analyser, version control. Sample activities:  
- Examine a typical IDE project structure; source code and binaries, file structure layout.  
- Build a test application (Hello World!) to utilise the components of an IDE.  
- Assignment 2 set. |
| Session 14 | LO3 Topic: Assignment workshop | Addressing issues and concerns with assignment. Sample activities:  
- An overview of assessment requirements  
- Question and answer session regarding assignment. |
| Session 15 | LO3 Topic: Implementing algorithms (part 1) | An overview of the implementation process. Sample activities:  
- Setup of a project with version control.  
- Use the IDE to develop an application. |
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<th>Sessions</th>
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<tr>
<td>Session 16</td>
<td>LO3 Topic: Implementing algorithms (part 2)</td>
<td>The implementation process continued, assignment workshop.</td>
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<td>Sample activities:</td>
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<tr>
<td></td>
<td></td>
<td>• Work on the assignment.</td>
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<td></td>
<td></td>
<td>• Use of best practice.</td>
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<tr>
<td>Session 17</td>
<td>LO3 Topic: Application development</td>
<td>Implement an application using algorithms for a specified purpose, assignment workshop.</td>
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<td>Sample activities:</td>
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<tr>
<td></td>
<td></td>
<td>• Continue development of application.</td>
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<tr>
<td></td>
<td></td>
<td>• Use of best practice.</td>
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<td>Session 18</td>
<td>LO4 Topic: Evaluating the debugging process</td>
<td>Internal testing and debugging an application using the IDE.</td>
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<td>Sample activities:</td>
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<td>• Use the features in the IDE to test and debug.</td>
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<td>• Identify features of the IDE that help with documentation and maintain a coding standard.</td>
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<tr>
<td>Session 19</td>
<td>LO3 &amp; 4 Topic: Application development</td>
<td>Working to the specification.</td>
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<td>Sample activities:</td>
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<td>• Adapting development of application according testing process.</td>
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<td>Session 20</td>
<td>LO3 &amp; 4 Topic: Assignment review workshop</td>
<td>Final submission of reports with code projects.</td>
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<td>Sample activities:</td>
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<td>• Conduct a review of the work to be submitted.</td>
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UNIT 2: Networking

For use with the Higher National Certificate and Higher National Diploma in Computing

First teaching from September 2017

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<td>Academic Year:</td>
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<tr>
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<tr>
<td>Examine networking principles and their protocols.</td>
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<tr>
<td>Explain networking devices and operations.</td>
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<tr>
<td>Design efficient networked systems.</td>
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<tr>
<td>Implement and diagnose networked systems.</td>
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| Session 1 | LO1 Topic: Role of networks | Introduction to the unit contents, assessment types, the significance of networking in communication technologies. Sample activities:  
- Discuss the benefits and constraints of different network types and standards.  
- Investigate the purpose, resource implications, communications, working practice, commercial opportunity, information sharing and collaboration. |
| Session 2 | LO1 Topic: System types | Analyse system types looking at real world scenario and networking types. Sample activities:  
- Discuss and study different system types.  
- Study the system types of peer based, client-server, cloud, cluster, centralised, virtualised. |
| Session 3 | LO1 Topic: Networking topology | Understand networking topology and explore the size of a required network. Sample activities:  
- Investigate logical topology (e.g. Ethernet, Token Ring).  
- Investigate physical topology (e.g. star, ring, bus, mesh, tree, ring).  
- Explain the impact of network topology, communication and bandwidth requirements. |
| Session 4 | LO1 Topic: Networking standards | Overview of OSI networking standards and explore the functionalities of different layers. Sample activities:  
- Explore and analyse conceptual models (e.g. OSI model, TCP/IP model), standards (e.g. IEEE 802.x).  
- Gain knowledge on 7-layer OSI reference model. |
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| Session 5 | LO2
Topic: Networking devices | Understand networking devices, their functionalities and selection decisions for network design. Sample activities:  
- Investigate networking devices and equipment.  
- Explore through servers; hub, routers; switches; multilayer switch, firewall, HIDS, repeaters; bridges; wireless devices; access point (wireless/wired), content filter, load balancer, modem, packet shaper, VPN concentrator.  
- Discuss and explore the operating principles of networking devices and server types. |
| Session 6 | LO2
Topic: Networking software | Networking software requirements, interfacing with hardware and design requirements. Sample activities:  
- Explore through client software, server software, client operating system, server operating system, firewall.  
- Investigate hardware (e.g. network card, cabling), permissions, system bus, local-system architecture (e.g. memory, processor, I/O devices). |
| Session 7 | LO2
Topic: Workstation, server selection | Server selection related to cost, performance and network size. Sample activities:  
- Develop a case study as a role play for a small organisation.  
- Discuss cost, purpose, operating system requirement.  
- Explore a range of server types and select server types and networking equipment required.  
- Justify the selection of a server regarding cost and performance optimisation. |
| Session 8 | LO1 & 2
Topic: Review and preparation for assessment tutorial | Overview of learning covered in the first half of the unit, prepare report for assessment, formal written assignment covering LO1 and LO2. Sample activities:  
- Review requirements for assessment.  
- Consider the assessment requirements, review progress, plan for completion of assessment. |
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| Session 9 | LO3 Topic: User requirements | The significance of user requirements for quality system development. Sample activities:  
  - Discuss quality expectations and the concept of system growth.  
  - Produce a test plan for the selected case study.  
  - Test and evaluate the design to meet the requirements.  
  - Discuss and analyse user feedback requirements for continuous system improvement. |
| Session 10 | LO3 Topic: Bandwidth | Understand bandwidth requirements and impact on network load. Sample activities:  
  - Investigate bandwidth requirements, cost constraints and throughput.  
  - Group work: Plan and design an observation form to investigate network load to investigate average and peak load.  
  - Record average load and anticipated peak load with access to different networking labs if possible. |
| Session 11 | LO3 & 2 Topic: Networking system communication | Plan and design a network system with a developed case study and analyse if it is fit for purpose. Sample activities:  
  - Design a networked system to meet a given specification for the case study selected.  
  - Investigate: Suited to devices, suited to users, supportive of lifestyle desires, supportive of commercial requirements.  
  - Justify the security requirements and quality of service needs. |
| Session 12 | LO3 Topic: Networking services and application | Understand IP addressing and domain name servers. Sample activities:  
  - DHCP, static versus dynamic IP addressing, reservations, scopes, leases, options (DNS servers, suffixes), IP helper, DHCP relay, DNS records, Dynamic DNS.  
  - Install and configure network services and applications. |
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<tr>
<td>Session 13</td>
<td>LO3 Topic: Scalable</td>
<td>Understand system scalability of enhancements and options for improvement. Sample activities: • Investigate what functionalities would allow a system to support device growth, support the addition of communication devices. • Discuss how to cope with bandwidth use and trend changes, protocol utilisation, addressing.</td>
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<tr>
<td>Session 14</td>
<td>LO3 Topic: Selection of components</td>
<td>Analytic factors for selection of networking components and their impacts. Sample activities: • Investigate supporting infrastructure needs. • Analyse supporting connectivity requirements.</td>
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<tr>
<td>Session 15</td>
<td>LO4 Topic: Networking devices</td>
<td>Understand installation of communication devices, allocation of addresses, local client configuration, server configuration and server installation. Sample activities: • Implement a networked system related to the design prepared in the LO1 and LO2 assessment.</td>
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<tr>
<td>Session 16</td>
<td>LO4 Topic: Verification of configuration and connectivity</td>
<td>Overview of connectivity verification methods. Sample activities: • Installation of internet work communication medium. • Conduct verification with (e.g. Ping, extended Ping, traceroute, telnet, SSH). • Record and evaluate Ping results as successful/unsuccessful.</td>
</tr>
<tr>
<td>Session 17</td>
<td>LO4 Topic: maintenance schedule</td>
<td>Plan and manage a maintenance schedule. Sample activities: • List steps for backup and restore depending on the network and operating systems you are using and upgrades. • Discuss the significance of upgrades and security requirements.</td>
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| Session 18 | LO4 Topic: Diagnose and resolve layer 1 problems | Document and analyse test outcomes against expected results. Sample activities:  
- Discuss the test techniques for framing, CRC, Runts and Giants.  
- Investigate dropped packets, late collisions and Input/Output errors. |
| Session 19 | LO4 Topic: Systems monitoring | Plan systems monitoring and future enhancement directions. Sample activities:  
- Recommend potential enhancements for the networked system.  
- Utilisation, bandwidth needs, monitoring user productivity. |
| Session 20 | LO3 & 4 Topic: Review and preparation for assessment tutorial | Overview of learning covered in the second half of the unit and collate the information (e.g. observation records, test results, design specification for assessment). Sample activities:  
- Review requirements for collating output and test results.  
- Consider the assessment requirements, review progress in gathering examples and plan for completion of the assessment. |