Higher National Unit specification

General information for centres

Unit title: Artificial Intelligence and Critical Thinking

Unit code: F871 35

Unit purpose: This Unit is designed to provide candidates with the knowledge and skills involved in critical thinking. It will also provide knowledge and skills involved in understanding how Artificial Intelligence (AI) is used in computer games. Working in teams, the candidates will be able to plan a strategy for implementing an intelligent component of a computer game and then they will be able to critically evaluate their plan. This Unit is intended for candidates who are proposing to follow a career in the computer games industry.

On completion of the Unit the candidate should be able to:

1   Understand the role of critical thinking in problem solving.
2   Explain the role of artificial intelligence in computer games.
3   Plan a strategy for an intelligent component of a computer game.
4   Critically evaluate the plan.

Credit points and level: 2 HN credits at SCQF level 8: (16 SCQF credit points at SCQF level 8*)

*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the centre. However, it is recommended that candidates have prior exposure to computer systems, and ideally some experience in using computer games. It would be advantageous for candidates to have a knowledge and understanding of game narrative and genre.

This may be demonstrated by the possession of relevant National Units, HN Units or experience, examples include:

F1K4 10   *Computer Games: Digital Gaming Design* (SCQF level 4)
F1R2 11   *Computer Games: Digital Games Design* (SCQF level 5)

Core Skills: There are opportunities to develop the Core Skills of *Problem Solving* and *Working with Others* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

General information for centres (cont)

Assessment: There are three assessments for this Unit. Outcome one is assessed by a single set of 5 restricted response questions based upon a case study or problem scenario.

Outcome 2 is assessed by an investigative assignment based upon a clearly defined set of instructions. The candidates must produce evidence of their investigative work in the form of a visual and oral presentation. A checklist must be utilised to ensure that all of the Knowledge and Skills for this Outcome are covered.

Outcomes 4 and 4 are assessed together as a teamwork assignment where candidates will work in teams of three or more, to produce evidence in the form of a portfolio of work demonstrating that they have covered all of the Knowledge and Skills for both Outcomes. The assignment undertaken will be based upon a brief and a checklist must be used to ensure that all of the Knowledge and Skills for both Outcomes are covered. In addition to the teamwork portfolio submission, individual diaries, blogs or log books will also be submitted as evidence. Confidential peer evaluations of candidates' performances will be undertaken for each team member.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment.

Assessment must be carried out in supervised conditions sufficient to ensure confidence in the authenticity of candidates' submissions.

Some of the Evidence Requirements may be produced using e-assessment. This may take the form of e-testing (for knowledge and understanding) and/or e-portfolios (for practical abilities). There is no requirement for you to seek prior approval if you wish to use e-assessment for either of these purposes so long as the normal standards for validity and reliability are observed. Please see the following SQA publications for further information on e-assessment: (i) *SQA Guidelines on Online Assessment for Further* Education (March 2003) and (ii) *Assessment and Quality Assurance in Open and Distance Learning* (Feb. 2001).

Higher National Unit specification: statement of standards

Unit title: Artificial Intelligence and Critical Thinking

Unit code: F871 35

The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Understand the role of critical thinking in problem solving

Knowledge and/or Skills

♦ Problem recognition and interpretation
♦ Assumptions and values
♦ Generalisations
♦ Logical inquiry and analysis
♦ Role of reasoning
♦ Role of reflection
♦ Role of evaluation
♦ Role of experience
♦ Accuracy of judgements
♦ Reasonable conclusions or solutions

Evidence Requirements

Written or oral evidence for the Knowledge and/or Skills in this Outcome will be provided by the candidate answering a representative sample of five restricted response questions based upon a case study or problem scenario. The candidate's written or oral response should be in the region of 100 words per question.

Candidates will demonstrate that they can:

♦ recognise and interpret a problem
♦ recognise any assumptions, generalisations and values
♦ undertake logical enquiry and analysis
♦ understand the roles of reasoning, experience, reflection and evaluation
♦ make accurate judgements and reach a reasonable conclusion or solution

Assessment must be undertaken in supervised conditions and is open book. The questions will be constructed to cover all of the Knowledge and Skills for this Outcome and the candidate should achieve a mark of 60% to pass. The candidate will be presented with a case study or problem scenario to read, analyse and interpret; they can bring along any notes, textbooks, handouts or other material. The assessment should take no longer than 90 minutes.

Higher National Unit specification: statement of standards (cont)

Unit title: Artificial Intelligence and Critical Thinking

Assessment Guidelines for Outcome 1

The candidate must provide written or oral evidence demonstrating that they have interpreted the problem, recognised any assumptions or generalisations therein, and provide a possible solution to the problem thus demonstrating that they can undertake logical enquiry and analysis.

Opportunity for re-assessment should be provided. The questions presented must change on **each** assessment occasion.

Outcome 2

Explain the role of Artificial Intelligence in computer games

Knowledge and/or Skills

♦ History and development of Artificial Intelligence in computer games
♦ Fuzzy Logic
♦ Knowledge-Based and Expert systems
♦ AI Agents
♦ Case-Based Reasoning Systems
♦ Search Algorithms and Path-finding systems
♦ Evaluation functions
♦ Current game AI techniques

Evidence Requirements

Candidates will complete an investigative assignment and produce evidence in the form of a visual presentation with oral commentary demonstrating that they have covered all of the Knowledge and Skills for this Outcome. This could take the form of an electronic presentation of a series of 12–18 slides with concise wording and should include appropriate diagrams, charts or images. Alternatively, a large poster consisting of key words, diagrams and images could be used. Candidates should be able to talk about their work and answer any questions.

Candidates will demonstrate that they can:

♦ explain how AI has developed in computer games
♦ describe the role and purpose of at least two search algorithms
♦ explain the role of Intelligent Agents within a game
♦ identify at least three game AI requirements
♦ explain two techniques used in AI to 'appear intelligent'
♦ describe at least three current game AI techniques

Assessment Guidelines for Outcome 2

The investigative assignment will consist of a clearly defined set of instructions for the candidate to follow to ensure that all of the Knowledge and Skills for this Outcome are covered. The candidate should be given time to carry out research, collect or create materials, and construct a presentation. A date for presenting work should then be agreed. A checklist should be used for marking; this will help to ensure that the assessment is valid and reliable and the instructions have been followed. The assessment is open book.

Higher National Unit specification: statement of standards (cont)

Unit title: Artificial Intelligence and Critical Thinking

Outcome 3

Plan a strategy for an intelligent component of a computer game

Knowledge and/or Skills

- Making strategic decisions
- Gathering and interpreting data
- Identifying Pertinent information
- Role of logical relationships between components/entities
- Progressive improvement
- Conceivable conclusions

Outcome 4

Critically evaluate the planned strategies

Knowledge and/or Skills

- Evaluation of evidence
- Testing generalisations and assumptions
- Reaching conclusions

Evidence Requirements for Outcomes 3 and 4

Outcomes 3 and 4 are assessed together as a teamwork assignment based upon a brief. Candidates will work in teams to produce evidence in the form of a single portfolio of work for the team which will cover all of the Knowledge and Skills for both Outcomes.

The Portfolio will consist of the following items collated by the team:

- an interpretative summary of the problem(s) given in the brief
- aims or goals for the plan to solve the problem(s)
- analysis of the facts and/or data presented in the brief which should include details of any assumptions or generalisations
- details of the game's strategy in relation to its AI
- planning documents which may include:
  — an outline of possible methods to be used to implement a component of AI
  — diagrams, flowcharts, or designs to demonstrate aspects of the plan or intelligent components
  — Pseudocode
  — notes from discussions or team blogs
  — any other relevant planning document assisting development of the knowledge or skills
- the plan
- amendments to the plan based upon critical evaluation
- an evaluative summary of the effectiveness of the final strategy
- log of team progress
- any other appropriate piece of work that incorporates the Knowledge and Skills for this Outcome

Higher National Unit specification: statement of standards (cont)

Unit title: Artificial Intelligence and Critical Thinking

In addition to the teamwork portfolio submission, individual evidence should also demonstrate the candidate's contribution to, and evaluation of, the final plan.

Individual evidence:
♦ Diary, blog or logbook containing comments, thoughts and reflections on progress

♦ Evidence of any information they have gathered to contribute to the team

♦ Evidence of any diagrams or charts they have assisted with to aid team decision making

♦ Notes that they have recognised any assumptions and discussed this with the team and have participated in testing these assumptions

Team evidence:
♦ Portfolio of work as detailed above

♦ Demonstrate that they have devised methods to solve the problem

♦ Gathered and interpreted data to enable informed choices for future action

♦ Progressively improve the desired Outcome of the situation or problem

♦ Test any generalisations and conclusions

♦ Justify the conclusion reached

Assessment Guidelines for Outcomes 3 and 4

Outcomes 3 and 4 are integrated into one assignment based upon a detailed brief which includes information about a computer based game that has intelligent components; the game can be added to or modified; thus providing the substance of the problem solving activity. This assignment is completed as a team and involves planning, problem solving and critical evaluation. A portfolio of evidence will be produced by the team (as detailed in the Evidence Requirements for this Outcome.) The assessment is open book and should take around 30 hours to complete.

The team should demonstrate how they have arrived at their final plan for the intelligent component of the game. This should not be in a single step but by a series of iterative measures based upon critical thinking and evaluation.

During this assignment the tutor's role is to mentor, as the learning process requires the candidates to think, reflect and evaluate for themselves. Any feedback provided should only address the issues surrounding the recording of thoughts and actions.

This assessment also involves each candidate keeping a record of their progress by making use of a blog, diary, log book or video diary where they reflect upon the team's progress and their own contribution to the team.

To ensure that every team member has contributed, confidential peer evaluations for every candidate should be completed using a questionnaire or pro forma to ascertain performance.

In order to provide remediation opportunities where a candidate has not contributed sufficiently to the team, one or more additional tasks can be negotiated and assigned by the Assessor.

Administrative Information

Unit code: F871 35

Unit title: Artificial Intelligence and Critical Thinking

Superclass category: CB

Original date of publication: August 2009

Version: 01

History of changes:

Version	Description of change	Date

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Higher National Unit specification: support notes

Unit title: Artificial Intelligence and Critical Thinking

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 80 hours.

Guidance on the content and context for this Unit

This Unit has been developed to form part of the HND Computer Games Development award and is suitable for candidates who are proposing to follow a career in the games industry. It is anticipated that the Unit would be delivered in the second year of the award if traditional delivery schedules are being observed.

Delivery of the Critical Thinking skills component of the Unit is in conjunction with the topic of Artificial intelligence as this not only provides a context in which to exhibit and apply critical thinking skills, but it also enables the candidate to learn about this important and significant aspect of computer games design and development.

Teamwork is an important aspect of learning in this Unit since when trying to solve problems it is often better to discuss ideas and work things out collectively.

Guidance on the delivery and assessment of this Unit

Where other Units often incorporate critical thinking skills indirectly, this Unit provides the opportunity to acquire Knowledge and Skills about this directly; the candidate will then be able to transfer this skill to other Units in the award, and to life.

Delivery of this Unit should be interesting, thought-provoking and stimulating, making use of problem solving activities which may or may not be related to games but will allow the candidates to think and reason to reach a solution. The candidates will be able to learn about themselves and others as well as learning about the implementation of AI in games.

Exemplar materials could be used to highlight how to write evaluative statements and to develop skills in self-reflection.

Higher National Unit specification: support notes (cont)

Unit title: Artificial Intelligence and Critical Thinking

Delivery of Outcome 1

This Outcome provides an opportunity to understand critical thinking processes and to investigate problem solving abilities.

When trying to solve a problem, often a clear cut solution is not possible. A solution can be something that evolves from a situation in unexpected ways and intelligent beings adapt and change their behaviour and thought processes accordingly; where a definite concrete solution is not possible a best case scenario can be justified and implemented.

In this Outcome the tutor could introduce a series of problem solving activities, some can be performed individually, and others in small groups. Class discussions should be an essential part of this Outcome where candidates can use their reasoning skills to solve the small problems presented to them. Following class room discussion the tutor can highlight key elements from the Knowledge and Skills and provide notes and/or handouts of essential points discussed.

For example, a formative group work activity could be to give the group a deliberately ambiguous problem scenario in which they will have to identify any assumptions, recognise generalisations, and make a clearer definition of the problem as they have interpreted it, then say how they would go about solving it and justify their solution.

Another example of methods to introduce problem solving and reasoning activities could be using a web based discussion forum, where a problem could be posted and the candidates are invited to tackle it. This again encourages collective reasoning and working with others to reach a possible solution. During lectures and discussions candidates should begin to realise that very often there is more than one possible solution to a problem and it can be tackled in many different ways.

Assessment of Outcome 1

All of the Knowledge and Skills bulleted points must be covered in class and the assessment questions used should be a representative sample, with a different set used on each occasion. The assessment for this Outcome involves five restricted response questions making use of a case study or problem scenario where the candidate's answers will demonstrate that they have addressed the Knowledge and Skills for this Outcome. The assessment should take no longer than 90 minutes and is open book.

The case study and the questions should be carefully constructed to ensure that the candidates' responses will provide evidence that they have covered the Knowledge and Skills for this Outcome. Each question could be given a value of 10 marks and cover at least 70% of the Knowledge and Skills for this Outcome. The response should be in the region of 100 words and to pass the Outcome a score of 60% must be achieved. The candidate must provide written or oral evidence demonstrating that they have interpreted the problem, recognised any assumptions or generalisations therein, and provide a possible solution to the problem by doing this they will have demonstrated that they can undertake logical enquiry and analysis.

Where remediation is required another set of questions and most probably a different case study or problem scenario should be used. Exemplar answers could be provided for markers to assist with allocating marks, however it should be remembered that students may offer perfectly valid solutions not featured in the exemplar.

Higher National Unit specification: support notes (cont)

Unit title: Artificial Intelligence and Critical Thinking

Delivery of Outcome 2

This Outcome provides the candidate with the opportunity of learning about the implementation of AI within computer games. For the delivery of this Outcome the tutor can use case studies of current strategic type game play to demonstrate and highlight AI features used in computer games. Where facilities allow, the candidates should be encouraged to play the game(s) to gain understanding of the strategies employed.

Formative assignments can be set where students use the internet, books and/or magazines to investigate AI in games. The tutor can present information in the form of lectures and tutorials and a variety of case study materials and examples to cover all of the Knowledge and Skills for this Outcome. The tutor could also set smaller research based assignments where the candidate has the opportunity to learn investigative skills in preparation for the assessment.

The candidate should reach an understanding of processes applied in AI and be able to explain them in the assessment

Assessment of Outcome 2

This Outcome is assessed using an investigative assignment which is open book and research based. The assignment will consist of a clearly defined set of instructions for the candidate to follow to ensure that all of the Knowledge and Skills for this Outcome are covered. It may be based on a case study of a strategy game or it can be specific instructions to elicit information to cover all of the Knowledge and Skills.

The candidate should be given time in the region of 10–12 hours to carry out research, collect or create materials, and construct a presentation. Alternatively, a poster composition can be created and this should be accompanied by an oral explanation. A date for presenting work should then be agreed. A checklist should be used for marking; this will help to ensure that the assessment is valid and reliable and the instructions have been followed.

By undertaking this investigation, candidates will demonstrate that they can:

♦ explain how AI has developed in computer games
♦ describe the role and purpose of at least two search algorithms
♦ explain the role of Intelligent Agents within a game
♦ identify at least three game AI requirements
♦ explain two techniques used in AI to 'appear intelligent'
♦ describe at least 3 current game AI techniques

Use of a checklist would be beneficial during the candidate's presentation in order to ensure that s/he has addressed either orally or in the presentation, all of the Evidence Requirements listed above. A time limit of 15 minutes maximum is suggested for the presentation.

Higher National Unit specification: support notes (cont)

Unit title: Artificial Intelligence and Critical Thinking

Delivery of Outcomes 3 and 4

The main aim for delivery of these Outcomes is to encourage candidates to apply what they have learned in the previous two Outcomes to plan an intelligent game component. The tutor's role is one of mentoring the teams through the problem solving activity encouraging teamwork and cooperation. These Outcomes provide the candidate with the opportunity of working with others to solve a problem. As the assignment progresses, there will be the opportunity to be creative, analytical and reflective as they get nearer to the final.

The problem they are presented with will provide them with a significant challenge where they will have to work together as a team and demonstrate how they are planning to implement and provide possible solutions. The candidates should work on this for a number of weeks as opposed to coming up with a quick solution.

Assessment of Outcomes 3 and 4

Candidates will work in teams of three or more, to produce evidence in the form of a single portfolio of work for the team which will cover all of the Knowledge and Skills for both Outcomes. Suggested contents of the portfolio is listed in the Evidence Requirements for these Outcomes

In this assessment it is the processes employed to reach a solution that are important rather than the solution itself. It is hoped that an iterative approach will be taken by the teams where, upon reflection, they can justify a better solution. There are no right or wrong answers and they are not required to have any functional piece of code or technology in place, however the assessor must be satisfied that they can demonstrate all of the Knowledge and Skills listed.

The context of AI within a game provides an ideal problem base as there are many factors to consider. This context will also provide the candidate with a greater understanding of AI in games. Teamwork culminates with the implementation of a confidential peer ballot where a tutor-devised pro forma will be completed to assess each candidate's contribution to the team. A cut off score can be used to determine the Outcome. Where a candidate has achieved a poor result they can be given the chance to be re-assessed by the tutor issuing a task for the individual(s) that is also agreed to, by the team.

The team could use a discussion forum to log team decisions and an individual blog, diary or video record could be kept by each candidate to monitor reflective thoughts, changes, amendments and the final evaluation.

The tutor may want to implement a checklist to ensure that the candidate has met the requirements for both Outcomes. During the problem solving assignment, the tutor should refrain from interfering or providing any form of feedback as the learning process requires the candidates to think, reflect and evaluate for themselves. Any feedback provided should only address the issues surrounding the recording of thoughts and actions. The final conclusion arrived at by the team should be defensible upon questioning and provide a reasonable conclusion for the allocated time frame.

Higher National Unit specification: support notes (cont)

Unit title: Artificial Intelligence and Critical Thinking

Approximate scheduling for each Outcome can be allocated as follows:

♦ Outcome 1 — 15 hours
♦ Outcome 2 — 20 hours
♦ Outcomes 3 and 4 — 40 hours

Remaining hours are allocated to feedback and/or remediation.

Opportunities for developing Core Skills

♦ All elements of the Core Skill of *Problem Solving* will be naturally developed and enhanced as candidates undertake the Unit. Effectiveness of solutions to problems are formally reviewed and evaluated on an on going basis in reflective logs.

♦ Skills are developed in accessing and evaluating a range of source materials undertaken by self-directed research. Analytical evaluation of AI could include a check on relevance, currency, future trends and effectiveness. If evidence is presented orally as part of a slide presentation, this will provide opportunities to practise complex verbal and non-verbal communication techniques and respond to questions confidently and in a way that progresses communication.

♦ Elements of the Core Skill *Working with Others* are developed and enhanced as candidates undertake the Unit. The ability to converse effectively with team members in order to make decisions and present information is an essential contribution to the evidence required to pass this Unit.

Open learning

If this Unit is delivered by open or distance learning methods, additional planning and resources may be required for candidate support, assessment and quality assurance. A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**

General information for candidates

Unit title: Artificial Intelligence and Critical Thinking

What this Unit is about

This Unit is about the knowledge and skills involved in critical thinking. Critical thinking is a skill which you already possess but are probably unaware of. This Unit will help you to understand and enhance this skill and then apply it to help you make decisions and solve problems.

The Unit is delivered within the context of Artificial Intelligence in computer games as this provides an ideal medium in which to study the way that decisions are made and the consequences that can result.

When you have gained an understanding of critical thinking processes and have undertaken some research into AI in games, you will then present your findings in the form of a slide presentation or poster. Finally, you will work as part of a team in an assignment where you will produce a portfolio of evidence to demonstrate how you plan to implement an intelligent component of a game.

What you will learn

♦   Critical thinking skills
♦   How AI can contribute to a game
♦   To plan for implementing an intelligent component of a game
♦   Processes involved in problem solving
♦   How to critically evaluate

On completion of the Unit you will be able to:

On completion of the Unit the candidate should be able to:

1   Understand the role of critical thinking in problem solving.
2   Explain the role of artificial intelligence in computer games.
3   Plan a strategy for an intelligent component of a computer game.
4   Critically evaluate the plan.