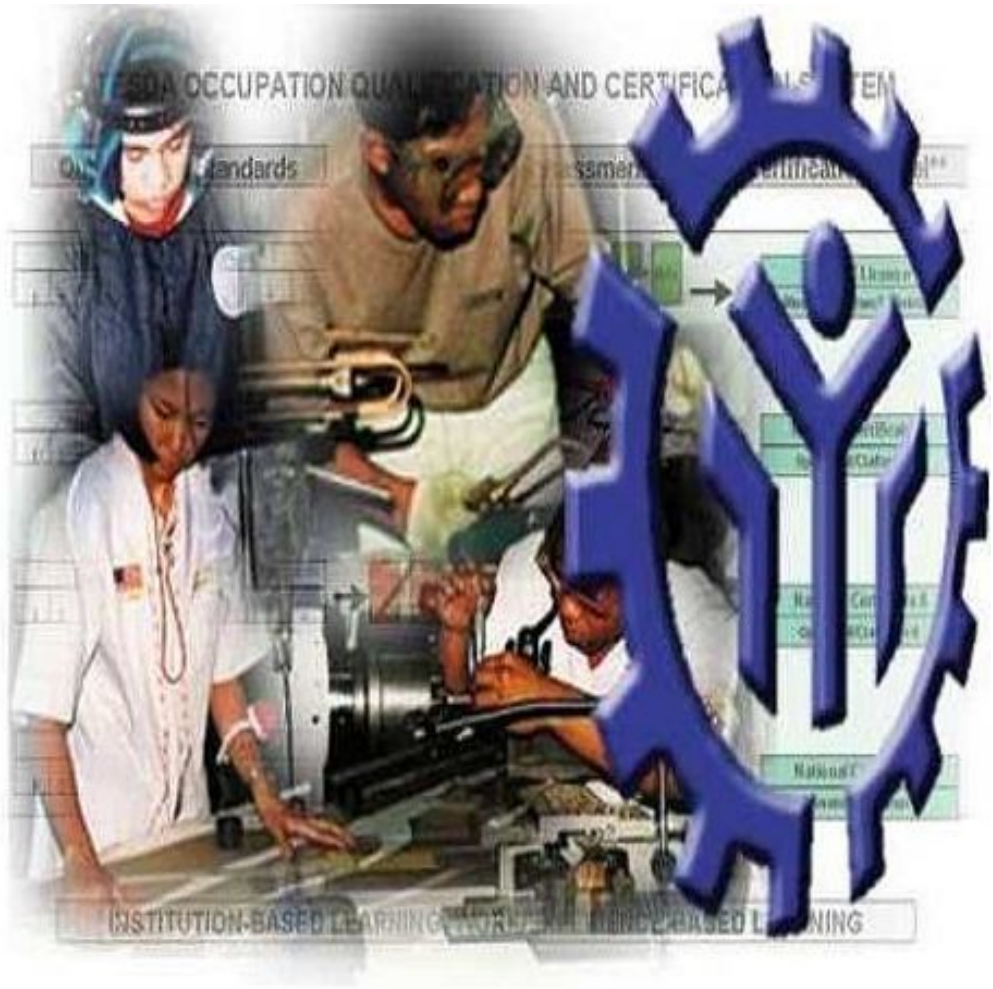
TRAINING REGULATIONS



GAME PROGRAMMING NC III

INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) SECTOR

TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
East Service Road, South Superhighway, Taguig City, Metro Manila

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ICT SECTOR

GAME PROGRAMMING

NATIONAL CERTIFICATE LEVEL III

TRAINING REGULATIONS FOR
GAME PROGRAMMING NC III

Section 1 GAME PROGRAMMING NC III QUALIFICATIONS

The **GAME PROGRAMMING NC III** Qualification consists of competencies that are required for programming stand-alone computer game applications.

The units of competency comprising this qualification include the following:

UNIT CODE	BASIC COMPETENCIES
5 00 311 1 09	Lead workplace communication
5 00 311 1 10	Lead small teams
5 00 311 1 11	Develop and practice negotiation skills
5 00 311 1 12	Solve problems related to work activities
5 00 311 1 13	Use mathematical concepts and techniques
5 00 311 1 14	Use relevant technologies

Code	COMMON COMPETENCIES
ICT315203	Apply critical thinking and thought organization
ICT315202	Apply quality standards
ICT311201	Perform computer operations

Code	CORE COMPETENCIES
ICT313352	Design game program logic
ICT313354	Apply object-oriented programming language skills
ICT313353	Apply programming skills for in-game application

A person who has achieved this Qualification is competent to be:

- Game Programmer
- Technical Game Designer
- Game Tester
- Tools Programmer
- Game Play Scripter

SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in **GAME PROGRAMMING NC III.**

BASIC COMPETENCIES

UNIT OF COMPETENCY : **LEAD WORKPLACE COMMUNICATION**

UNIT CODE : 500311109

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to lead in the dissemination and discussion of ideas, information and issues in the workplace.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Communicate information about workplace processes	1.1. Appropriate ***communication method*** is selected 1.2. Multiple operations involving several topics areas are communicated accordingly 1.3. Questions are used to gain extra information 1.4. Correct sources of information are identified 1.5. Information is selected and organized correctly 1.6. Verbal and written reporting is undertaken when required 1.7. Communication skills are maintained in all situations
2. Lead workplace discussions	2.1. Response to workplace issues are sought 2.2. Response to workplace issues are provided immediately 2.3. Constructive contributions are made to workplace discussions on such issues as production, quality and safety 2.4. Goals/objectives and action plan undertaken in the workplace are communicated
3. Identify and communicate issues arising in the workplace	3.1. Issues and problems are identified as they arise 3.2. Information regarding problems and issues are organized coherently to ensure clear and effective communication 3.3. Dialogue is initiated with appropriate personnel 3.4. Communication problems and issues are raised as they arise

RANGE OF VARIABLES

VARIABLE	RANGE
1. Methods of communication	1.1. Non-verbal gestures 1.2. Verbal 1.3. Face to face 1.4. Two-way radio 1.5. Speaking to groups 1.6. Using telephone 1.7. Written 1.8. Internet

EVIDENCE GUIDE

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1. Dealt with a range of communication/information at one time 1.2. Made constructive contributions in workplace issues 1.3. Sought workplace issues effectively 1.4. Responded to workplace issues promptly 1.5. Presented information clearly and effectively written form 1.6. Used appropriate sources of information 1.7. Asked appropriate questions 1.8. Provided accurate information
2. Required Knowledge and Attitude	2.1. Organization requirements for written and electronic communication methods 2.2. Effective verbal communication methods
3. Required Skills	3.1. Organize information 3.2. Understand and convey intended meaning 3.3. Participate in variety of workplace discussions 3.4. Comply with organization requirements for the use of written and electronic communication methods
4. Resource Implications	The following resources **MUST** be provided: 4.1. Variety of Information 4.2. Communication tools 4.3. Simulated workplace
5. Methods of Assessment	Competency may be assessed through: 5.1. Competency in this unit must be assessed through 5.2. Direct Observation 5.3. Interview
6. Context for Assessment	6.1. Competency may be assessed in the workplace or in simulated workplace environment

UNIT OF COMPETENCY: LEAD SMALL TEAMS

UNIT CODE : 500311110

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes to lead small teams including setting and maintaining team and individual performance standards.

ELEMENT	PERFORMANCE CRITERIA *Italicized* terms are elaborated in the Range of Variables
1. Provide team leadership	1.1. ***Work requirements*** are identified and presented to team members 1.2. Reasons for instructions and requirements are communicated to team members 1.3. ***Team members' queries and concerns*** are recognized, discussed and dealt with
2. Assign responsibilities	2.1. Duties, and responsibilities are allocated having regard to the skills, knowledge and aptitude required to properly undertake the assigned task and according to company policy 2.2. Duties are allocated having regard to individual preference, domestic and personal considerations, whenever possible
3. Set performance expectations for team members	3.1. Performance expectations are established based on client needs and according to assignment requirements 3.2. Performance expectations are based on individual team members duties and area of responsibility 3.3. Performance expectations are discussed and disseminated to individual team members
4. Supervise team performance	4.1. ***Monitoring of performance*** takes place against defined performance criteria and/or assignment instructions and corrective action taken if required 4.2. Team members are provided with ***feedback,*** positive support and advice on strategies to overcome any deficiencies 4.3. ***Performance issues*** which cannot be rectified or addressed within the team are referenced to appropriate personnel according to employer policy 4.4. Team members are kept informed of any changes in the priority allocated to assignments or tasks which might impact on client/customer needs and satisfaction 4.5. Team operations are monitored to ensure that employer/client needs and requirements are met 4.6. Follow-up communication is provided on all issues affecting the team 4.7. All relevant documentation is completed in accordance with company procedures

RANGE OF VARIABLES

VARIABLE	RANGE
1. Work requirements	1.1. Client Profile 1.2. Assignment instructions
2. Team member's concerns	2.1. Roster/shift details
3. Monitor performance	3.1. Formal process 3.2. Informal process
4. Feedback	4.1. Formal process 4.2. Informal process
5. Performance issues	5.1. Work output 5.2. Work quality 5.3. Team participation 5.4. Compliance with workplace protocols 5.5. Safety 5.6. Customer service

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1. Maintained or improved individuals and/or team performance given a variety of possible scenario 1.2. Assessed and monitored team and individual performance against set criteria 1.3. Represented concerns of a team and individual to next level of management or appropriate specialist and to negotiate on their behalf 1.4. Allocated duties and responsibilities, having regard to individual's knowledge, skills and aptitude and the needs of the tasks to be performed 1.5. Set and communicated performance expectations for a range of tasks and duties within the team and provided feedback to team members
2. Required Knowledge and Attitude	2.1. Company policies and procedures 2.2. Relevant legal requirements 2.3. How performance expectations are set 2.4. Methods of Monitoring Performance 2.5. Client expectations 2.6. Team member's duties and responsibilities
3. Required Skills	3.1. Communication skills required for leading teams 3.2. Informal performance counseling skills 3.3. Team building skills 3.4. Negotiating skills
4. Resource Implications	The following resources **MUST** be provided: 4.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 4.2. Materials relevant to the proposed activity or task
5. Methods of Assessment	Competency may be assessed through: 5.1. Direct observations of work activities of the individual member in relation to the work activities of the group 5.2. Observation of simulation and/or role play involving the participation of individual member to the attainment of organizational goal 5.3. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork
6. Context of Assessment	6.1. Competency assessment may occur in workplace or any appropriately simulated environment 6.2. Assessment shall be observed while task are being undertaken whether individually or in-group

UNIT OF COMPETENCY: DEVELOP AND PRACTICE NEGOTIATION SKILLS

UNIT CODE : 500311111

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes required to collect information in order to negotiate to a desired outcome and participate in the negotiation.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Plan negotiations	1.1 Information on ***preparing for negotiation*** is identified and included in the plan 1.2 Information on creating ***non verbal environments*** for positive negotiating is identified and included in the plan 1.3 Information on ***active listening*** is identified and included in the plan 1.4 Information on different ***questioning techniques*** is identified and included in the plan 1.5 Information is checked to ensure it is correct and up-to- date
2. Participate in negotiations	2.1 Criteria for successful outcome are agreed upon by all parties 2.2 Desired outcome of all parties are considered 2.3 Appropriate language is used throughout the negotiation 2.4 A variety of questioning techniques are used 2.5 The issues and processes are documented and agreed upon by all parties 2.6 Possible solutions are discussed and their viability assessed 2.7 Areas for agreement are confirmed and recorded 2.8 Follow-up action is agreed upon by all parties

RANGE OF VARIABLES

VARIABLE	RANGE
1. Preparing for negotiation	1.1 Background information on other parties to the negotiation 1.2 Good understanding of topic to be negotiated 1.3 Clear understanding of desired outcome/s 1.4 Personal attributes 1.4.1 self awareness 1.4.2 self esteem 1.4.3 objectivity 1.4.4 empathy 1.4.5 respect for others 1.5 Interpersonal skills 1.5.1 listening/reflecting 1.5.2 non verbal communication 1.5.3 assertiveness 1.5.4 behavior labeling 1.5.5 testing understanding 1.5.6 seeking information 1.5.7 self disclosing 1.6 Analytic skills 1.6.1 observing differences between content and process 1.6.2 identifying bargaining information 1.6.3 applying strategies to manage process 1.6.4 applying steps in negotiating process 1.6.5 strategies to manage conflict 1.6.6 steps in negotiating process 1.6.7 options within organization and externally for resolving conflict
2. Non-verbal environments	2.1 Friendly reception 2.2 Warm and welcoming room 2.3 Refreshments offered 2.4 Lead in conversation before negotiation begins
3. Active listening	3.1 Attentive 3.2 Don't interrupt 3.3 Good posture 3.4 Maintain eye contact 3.5 Reflective listening
4. Questioning techniques	4.1 Direct 4.2 Indirect 4.3 Open-ended

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrated sufficient knowledge of the factors influencing negotiation to achieve agreed outcome 1.2 Participated in negotiation with at least one person to achieve an agreed outcome
2. Required Knowledge and Attitude	2.1 Codes of practice and guidelines for the organization 2.2 Organizations policy and procedures for negotiations 2.3 Decision making and conflict resolution strategies procedures 2.4 Problem solving strategies on how to deal with unexpected questions and attitudes during negotiation 2.5 Flexibility 2.6 Empathy
3. Required Skills	3.1 Interpersonal skills to develop rapport with other parties 3.2 Communication skills (verbal and listening) 3.3 Observation skills 3.1 Negotiation skills
4. Resource Implications	The following resources **MUST** be provided: 4.1 Room with facilities necessary for the negotiation process 4.2 Human resources (negotiators)
5. Methods of Assessment	Competency may be assessed through: 5.1 Observation/demonstration and questioning 5.2 Portfolio assessment 5.3 Oral and written questioning 5.4 Third party report
6. Context for Assessment	6.1 Competency to be assessed in real work environment or in a simulated workplace setting.

UNIT OF COMPETENCY: **SOLVE PROBLEMS RELATED TO WORK ACTIVITIES**

UNIT CODE : **500311112**

UNIT DESCRIPTOR : This unit of covers the knowledge, skills and attitudes required to solve problems in the workplace including the application of problem solving techniques and to determine and resolve the root cause of problems.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Identify the problem	1.1. Variances are identified from normal operating parameters; and product quality 1.2. Extent, cause and nature are of the problem are defined through observation, investigation and ***analytical techniques*** 1.3. ***Problems*** are clearly stated and specified
2. Determine fundamental causes of the problem	2.1. Possible causes are identified based on experience and the use of problem solving tools / analytical techniques. 2.2. Possible cause statements are developed based on findings 2.3. Fundamental causes are identified per results of investigation conducted
3. Determine corrective action	3.1. All possible options are considered for resolution of the problem 3.2. Strengths and weaknesses of possible options are considered 3.3. Corrective actions are determined to resolve the problem and possible future causes 3.4. **Action *plans*** are developed identifying measurable objectives, resource needs and timelines in accordance with safety and operating procedures
4. Provide recommendation/s to manager	4.1. Report on recommendations are prepared 4.2. Recommendations are presented to appropriate personnel. 4.3. Recommendations are followed-up, if required

RANGE OF VARIABLES

VARIABLE	RANGE
1. Analytical techniques	1.1. Brainstorming 1.2. Intuitions/Logic 1.3. Cause and effect diagrams 1.4. Pareto analysis 1.5. SWOT analysis 1.6. Gant chart, Pert CPM and graphs 1.7. Scatter grams
2. Problem	2.1. Non - routine process and quality problems 2.2. Equipment selection, availability and failure 2.3. Teamwork and work allocation problem 2.4. Safety and emergency situations and incidents
3. Action plans	3.1. Priority requirements 3.2. Measurable objectives 3.3. Resource requirements 3.4. Timelines 3.5. Co-ordination and feedback requirements 3.6. Safety requirements 3.7. Risk assessment 3.8. Environmental requirements

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1. Identified the problem 1.2. Determined the fundamental causes of the problem 1.3. Determined the correct / preventive action 1.4. Provided recommendation to manager These aspects may be best assessed using a range of scenarios / case studies / what ifs as a stimulus with a walk through forming part of the response. These assessment activities should include a range of problems, including new, unusual and improbable situations that may have happened.
2. Required Knowledge and Attitude	2.1. Competence includes a thorough knowledge and understanding of the process, normal operating parameters, and product quality to recognize non-standard situations 2.2. Competence to include the ability to apply and explain, sufficient for the identification of fundamental cause, determining the corrective action and provision of recommendations 2.2.1. Relevant equipment and operational processes 2.2.2. Enterprise goals, targets and measures 2.2.3. Enterprise quality, OHS and environmental requirement 2.2.4. Principles of decision making strategies and techniques 2.2.5. Enterprise information systems and data collation 2.2.6. Industry codes and standards
3. Required Skills	3.1. Using range of formal problem solving techniques 3.2. Identifying and clarifying the nature of the problem 3.3. Devising the best solution 3.4. Evaluating the solution 3.5. Implementation of a developed plan to rectify the problem

4. Resource Implications	4.1. Assessment will require access to an operating plant over an extended period of time, or a suitable method of gathering evidence of operating ability over a range of situations. A bank of scenarios / case studies / what ifs will be required as well as bank of questions which will be used to probe the reason behind the observable action.
5. Methods of Assessment	Competency may be assessed through: 5.1. Case studies on solving problems in the workplace 5.2. Observation The unit will be assessed in a holistic manner as is practical and may be integrated with the assessment of other relevant units of competency. Assessment will occur over a range of situations, which will include disruptions to normal, smooth operation. Simulation may be required to allow for timely assessment of parts of this unit of competency. Simulation should be based on the actual workplace and will include walk through of the relevant competency components.
6. Context of Assessment	6.1. In all workplace, it may be appropriate to assess this unit concurrently with relevant teamwork or operation units.

UNIT OF COMPETENCY: **USE MATHEMATICAL CONCEPTS AND TECHNIQUES**

UNIT CODE : **500311113**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required in the application of mathematical concepts and techniques.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Identify mathematical tools and techniques to solve problem	1.1 Problem areas are identified based on given condition 1.2 ***Mathematical techniques*** are selected based on the given problem
2. Apply mathematical procedure/solution	2.1 Mathematical techniques are applied based on the problem identified 2.2 Mathematical computations are performed to the level of accuracy required for the problem 2.3 Results of mathematical computation is determined and verified based on job requirements
3. Analyze results	3.1 Result of application is reviewed based on expected and required specifications and outcome 3.2 ***Appropriate action*** is applied in case of error

RANGE OF VARIABLES

VARIABLE	RANGE
1. Mathematical techniques	May include but are not limited to: 1.1 Four fundamental operations 1.2 Measurements 1.3 Use/Conversion of units of measurements 1.4 Use of standard formulas
2. Appropriate action	2.1 Review in the use of mathematical techniques (e.g. recalculation, re-modeling) 2.2 Report error to immediate superior for proper action

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified, applied and reviewed the use of mathematical concepts and techniques to workplace problems
2. Required Knowledge and Attitude	2.1 Fundamental operation (addition, subtraction, division, multiplication) 2.2 Measurement system 2.3 Precision and accuracy 2.4 Basic measuring tools/devices
3. Required Skills	3.1 Applying mathematical computations 3.2 Using calculator 3.3 Using different measuring tools
4. Resource Implications	The following resources **MUST** be provided: 4.1 Calculator 4.2 Basic measuring tools 4.3 Case Problems
5. Methods of Assessment	Competency may be assessed through: 5.1 Authenticated portfolio 5.2 Written Test 5.3 Interview/Oral Questioning 5.4 Demonstration
6. Context of Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY: USE RELEVANT TECHNOLOGIES

UNIT CODE : 500311114

UNIT DESCRIPTOR : This unit of competency covers the knowledge, skills, and attitude required in selecting, sourcing and applying appropriate and affordable technologies in the workplace.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Study/select appropriate technology	1.1 Usage of different ***technologies*** is determined based on job requirements 1.2 Appropriate technology is selected as per work specification
2. Apply relevant technology	2.1 Relevant technology is effectively used in carrying out function 2.2 Applicable software and hardware are used as per task requirement 2.3 ***Management concepts*** are observed and practiced as per established industry practices
3. Maintain/enhance relevant technology	3.1 Maintenance of technology is applied in accordance with the ***industry standard operating procedure***, ***manufacturer's operating guidelines*** and ***occupational health and safety procedure*** to ensure its operative ability 3.2 Updating of technology is maintained through continuing education or training in accordance with job requirement 3.3 Technology failure/ defect is immediately reported to the concern/responsible person or section for ***appropriate action***

RANGE OF VARIABLES

VARIABLE	RANGE
1. Technology	May include but are not limited to: 1.1 Office technology 1.2 Industrial technology 1.3 System technology 1.4 Information technology 1.5 Training technology
2. Management concepts	May include but are not limited: 2.1 Real Time Management 2.2 KAIZEN or continuous improvement 2.3 5s 2.4 Total Quality Management 2.5 Other management/productivity tools
3. Industry standard operating procedure	3.1 Written guidelines relative to the usage of office technology/equipment 3.2 Verbal advise/instruction from the co-worker
4. Manufacturer's operating guidelines/ instructions	4.1 Written instruction/manuals of specific technology/ equipment 4.2 General instruction manual 4.3 Verbal advise from manufacturer relative to the operation of equipment
5. Occupational health and safety procedure	5.1 Relevant statutes on OHS 5.2 Company guidelines in using technology/equipment
6. Appropriate action	6.1 Implementing preventive maintenance schedule 6.2 Coordinating with manufacturer's technician

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Studied and selected appropriate technology consistent with work requirements 1.2 Applied relevant technology 1.3 Maintained and enhanced operative ability of relevant technology
2. Required Knowledge and Attitude	2.1 Awareness on technology and its function 2.2 Repair and maintenance procedure 2.3 Operating instructions 2.4 Applicable software 2.5 Communication techniques 2.6 Health and safety procedure 2.7 Company policy in relation to relevant technology 2.8 Different management concepts 2.9 Technology adaptability
3. Required Skills	3.1 Relevant technology application/implementation 3.2 Basic communication skills 3.3 Software applications skills 3.4 Basic troubleshooting skills
4. Resource Implications	The following resources **MUST** be provided: 4.1 Relevant technology 4.2 Interview and demonstration questionnaires 4.3 Assessment packages
5. Methods of Assessment	Competency must be assessed through: 5.1 Interview 5.2 Actual demonstration 5.3 Authenticated portfolio (related certificates of training/seminar)
6. Context of Assessment	6.1 Competency may be assessed in actual workplace or simulated environment

COMMON COMPETENCIES

UNIT TITLE : **APPLY CRITICAL THINKING AND THOUGHT ORGANIZATION**

UNIT CODE : **ICT315203**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, attitudes and values needed to develop the ability to extract and use relevant data. This unit will enhance the ability to critically assess the data or information gathered in order to make sound arguments, informed decisions and problem solving.

ELEMENTS	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Identify the theoretical foundations of critical thinking	1.1. Assess and choose one of the ***study methods*** to effective data gathering, decision-making and problem solving. 1.2. Identify the ***components of critical thinking***. 1.3. Identify the impediments of critical thinking to avoid them in data gathering and decision making situations. 1.4. Identify the ***types of claims***.
2. Develop constructive arguments	2.1. Establish the premise and possible conclusion based on the information provided from a job or industry scenario. 2.2. Use ***methods of careful analysis*** to make constructive arguments based on a job or industry scenario.
3. Apply methods of reasoning	3.1. Analogies are used to support reasoning. 3.2. Identify the cause and effects based on the criteria or information provided to support reasoning. 3.3. Identify and avoid the ***common mistakes in reasoning about causes***. 3.4. Make evaluations based on the criteria or information provided.

4. Affirm generalization	4.1. Use past experiences to come up with a good generalization. 4.2. Use ***appropriate samples*** to support generalization. 4.3. Validate the generalization with margin of errors, variation in population and risk.
5. Arrive at a conclusion	5.1. Make rational arguments using the ***elements of reasoning.*** 5.2. Clarify conceptual ideas using organized gathered data and evidences 5.3. ***Alternatives*** are worked out to place argument in the context of study. 5.4. Challenge or validate the position of the conclusion and make counter responses to emphasize a viewpoint.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Study methods	May include but are not limited to: 1.1 Creating schedules 1.2 Prioritizing tasks 1.3 Researching on resources
2. Components of critical thinking	May include but are not limited to: 2.1 Motivation 2.2 Set of information 2.3 Belief generating 2.4 Processing skills 2.5 Intellectual commitment 2.6 Using skills to guide behavior 2.7 Possession of a set of skills 2.8 Skillful manipulation of ideas 2.9 Exercise without acceptance of skill results
3. Types of claims	3.1 Objective 3.2 Subjective 3.3 Moral claims
4. methods of careful analysis	May include but are not limited to: 4.1 Clarity

	4.2 Fill in connecting premises 4.3 Thought organization
5. Common mistakes in reasoning about causes	May include but are not limited to: 5.1 Logical fallacies 5.2 Over-analysis 5.3 Biased Thinking 5.4 Unawareness/Decisions made based on incomplete information 5.5 Bandwagon Mentality 5.6 Reversing cause and effect
6. Appropriate samples	May pertain but are not limited to: 6.1 Representative of the population being studied 6.2 Sample size 6.3 Depth of the study conducted using the sample
7. Elements of reasoning	May pertain but are not limited to: 7.1 Purpose 7.2 Question at issue 7.3 Assumptions 7.4 Implications 7.5 Consequences 7.6 Information 7.7 Concept 7.8 Conclusions interpretations 7.9 Point of view 7.10 Alternatives 7.11 Context
8. Alternatives	May include but are not limited to: 8.1 Role playing 8.2 Viewing of media clips 8.3 Questioning 8.4 Mind mapping 8.5 Simulation 8.6 Demonstration

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment must show that the candidate: 1.1 Extract and processed relevant data 1.2 Recognize fact from fiction 1.3 Reason with constructive arguments 1.4 Reason using analogies, and cause and effect as part of the argument 1.5 Evaluate scenarios and explanations 1.6 Recognize and evaluated assumptions 1.7 Identify the theoretical foundations of **critical thinking**
2. Required Knowledge and Attitude	2.1 Thought organization 2.2 Logic 2.3 Basic statistics 2.4 Reasoning
3. Required skills	3.1 Writing skills 3.2 Thought organization 3.3 Negotiation skills
4. Method of assessment	Competency may be assessed through: 4.1 Direct Observation and Oral Questioning 4.2 Proficiency in doing written analysis 4.3 Practical demonstration 4.4 Indirect observation through coaching
5. Resource implication	The following resources **MUST** be provided: 5.1 Case studies 5.2 Paper and pen
6. Context of Assessment	6.1 Competency may be assessed in the work place or in a simulated work place setting

UNIT TITLE : **APPLY QUALITY STANDARDS**

UNIT CODE : **ICT315202**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, attitudes and values needed to apply quality standards in the workplace. The unit also includes the application of relevant safety procedures and regulations, organization procedures and customer requirements.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Assess quality of received materials	1.1. Work instruction is obtained and work is carried out in accordance with standard operating procedures. 1.2. Received ***materials*** are checked against workplace standards and specifications. 1.3. Faulty materials related to work are identified and isolated. 1.4. ***Faults*** and any identified causes are recorded and/or reported to the supervisor concerned in accordance with workplace procedures. 1.5. Faulty materials are replaced in accordance with workplace procedures.
2. Assess own work	2.1. ***Documentation*** relative to quality within the company is identified and used. 2.2. Completed work is checked against workplace standards relevant to the task undertaken. 2.3. ***Errors*** are identified and isolated. 2.4. Information on the quality and other indicators of production performance are recorded in accordance with workplace procedures. 2.5. In cases of deviations from specific ***quality standards***, causes are documented and reported in accordance with the workplace' s standards operating procedures.
3. Engage in quality improvement	3.1. Process improvement procedures are participated in relative to workplace assignment. 3.2. Work is carried out in accordance with process improvement procedures. 3.3. Performance of operation or quality of product of service to ensure ***customer*** satisfaction is monitored.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials	1.1 Materials May include but are not limited: 1.1.1. Manuals 1.1.2. Job orders 1.1.3. Instructional videos
2. Faults	2.1 Faults May include but are not limited: 2.1.1. Materials not to specification 2.1.2. Materials contain incorrect/outdated information 2.1.3. Hardware defects 2.1.4. Materials that do not conform with any regulatory agencies
3. Documentation	3.1 Organization work procedures 3.2 Manufacturer's instruction manual 3.3 Customer requirements 3.4 Forms
4. Errors	4.1 Errors may be related but not limited to the following: 4.1.1. Deviation from the requirements of the Client 4.1.2. Deviation from the requirement of the organization
5. Quality standards	5.1 Quality standards may be related but not limited to the following: 5.1.1. Materials 5.1.2. Hardware 5.1.3. Final product 5.1.4. Production processes 5.1.5. Customer service
6. Customer	6.1 Co-worker 6.2 Supplier/Vendor 6.3 Client 6.4 Organization receiving the product or service

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment must show that the candidate: 1.1 Carried out work in accordance with the company's standard operating procedures 1.2 Performed task according to specifications 1.3 Reported defects detected in accordance with standard operating procedures 1.4 Carried out work in accordance with the process improvement procedures
2. Required Knowledge and Attitude	2.1 Relevant production processes, materials and products 2.2 Characteristics of materials, software and hardware used in production processes 2.3 Quality checking procedures 2.4 Workplace procedures 2.5 Safety and environmental aspects of production processes 2.6 Fault identification and reporting 2.7 Quality improvement processes
3. Required Skills	3.1 Reading skills required to interpret work instruction 3.2 Communication skills needed to interpret and apply defined work procedures 3.3 Carry out work in accordance with OHS policies and procedures 3.4 Critical thinking 3.5 Solution providing and decision-making
4. Method of Assessment	The assessor must select two of the following to objectively evaluate the candidate: 4.1 Observation and oral questioning 4.2 Third party report 4.3 Portfolio 4.4 Practical demonstration
5. Resource Implication	Materials, software and hardware to be used in a real or simulated situation
6. Context of Assessment	Assessment may be conducted in the workplace or in a simulated environment

UNIT TITLE : **PERFORM COMPUTER OPERATIONS**

UNIT CODE : **ICT311203**

UNIT DESCRIPTOR : This unit covers the knowledge, skills, attitudes and values needed to perform computer operations which include inputting, accessing, producing and transferring data using the appropriate hardware and software.

ELEMENTS	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Plan and prepare for task to be taken undertaken	1.1. Requirements of task are determined in accordance with the required output. 1.2. Appropriate ***hardware*** and ***software*** are selected according to task assigned and required outcome. 1.3. Task is planned to ensure that ***OH & S guidelines*** *and* procedures are followed. 1.4. Client -specific guidelines and procedures are followed. 1.5. Required data security guidelines are applied in accordance with existing procedures.
2. Input data into computer	2.1. Data are entered into the computer using appropriate program/application in accordance with company procedures. 2.2. Accuracy of information is checked and information is saved in accordance with standard operating procedures. 2.3. Inputted data is stored in ***storage media*** according to requirements. 2.4. Work is performed within ***ergonomic guidelines.***
3. Access information using computer	3.1. Correct program/application is selected based on job requirements. 3.2. Program/application containing the information required is accessed according to company procedures. 3.3. ***Desktop icons*** are correctly selected, opened and closed for navigation purposes. 3.4. Keyboard techniques are carried out in line with OH & S requirements for safe use of keyboards.

4. Produce output/ data using computer system	4.1. Entered data are processed using appropriate software commands. 4.2. Data are printed out as required using computer hardware /peripheral devices in accordance with standard operating procedures. 4.3. Files and data are transferred between compatible systems using computer software, hardware/peripheral devices in accordance with standard operating procedures.
5. Use basic functions of a www-browser to locate information	5.1. Information requirements for internet search are established. 5.2. Browser is launched. 5.3. Search engine is loaded. 5.4. Appropriate search criteria/or URL of site is entered. 5.5. Relevant links are followed to locate required information. 5.6. Useful pages are bookmarked or printed as required.
6. Maintain computer equipment and systems	6.1. Procedures for ensuring security of data, including regular back-ups and virus checks are implemented in accordance with standard operating procedures. 6.2. Basic file maintenance procedures are implemented in line with the standards operating procedures.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Hardware and peripheral devices	1.1 Personal computers 1.2 Networked systems 1.3 Communication equipment 1.4 Printers 1.5 Scanners 1.6 Keyboard 1.7 Mouse 1.8 Voice/Data logger
2. Software	Software includes the following but not limited to: 2.1 Word processing packages 2.2 Database packages 2.3 Internet 2.4 Spreadsheets 2.5 Client Specific Software
3. OH & S guidelines	3.1 OHS guidelines 3.2 Enterprise procedures
4. Storage media	Storage media include the following but not limited to: 4.1 Diskettes 4.2 CDs 4.3 Zip disks 4.4 hard disk drives, local and remote 4.5 Optical drives
5. Ergonomic guidelines	5.1 Types of equipment used 5.2 Appropriate furniture 5.3 Seating posture 5.4 Lifting posture 5.5 Visual display unit screen brightness

6. Desktop icons	6.1 Icons include the following but not limited to: 6.2 Directories/folders 6.3 Files 6.4 Network devices 6.5 Recycle bin 6.6 Program icons
7. Maintenance	7.1 Creating and managing more space in the hard disk and other peripherals 7.2 Reviewing programs 7.3 Deleting unwanted files 7.4 Backing up files 7.5 Checking hard drive for errors 7.6 Using up to date anti-virus programs 7.7 Cleaning dust from internal and external surfaces

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment must show that the candidate: 1.1 Selected and used hardware components correctly and according to the task requirement 1.2 used basic software applications to create new files and documents 1.3 Produced accurate and complete data in accordance with the requirements 1.4 Used appropriate devices and procedures to transfer files/data accurately 1.5 Used basic functions of a www-browser to locate information.
2. Required Knowledge and Attitude	2.1 Basic ergonomics of keyboard and computer user 2.2 Main types of computers and basic features of different operating systems 2.3 Main parts of a computer 2.4 Storage devices and basic categories of memory 2.5 Relevant types of software 2.6 General security, privacy legislation and copyright 2.7 Viruses 2.8 OH & S principles and responsibilities 2.9 Calculating computer capacity 2.10 Productivity Application 2.11 Business Application 2.12 System Software
3. Required skills	3.1 Reading and comprehension skills required to interpret work instruction and to interpret basic user manuals. 3.2 Communication skills to identify lines of communication, request advice, follow instructions and receive feedback. 3.3 Technology skills to use equipment safely including keyboard skills.
4. Method of assessment	The assessor may select two of the following assessment methods to objectively assess the candidate: 4.1 Direct Observation and Oral Questioning 4.2 Practical demonstration
5. Resource implication	5.1 Computer hardware with peripherals 5.2 Appropriate software
6. Context of Assessment	6.1 Competency may be assessed in workplace or simulated environment.

CORE COMPETENCIES

UNIT TITLE : **DESIGN GAME PROGRAM LOGIC**

UNIT CODE : **ICT 313352**

UNIT DESCRIPTOR : This unit defines the knowledge, skills and attitudes required to design various game program logic to ensure that there is understanding of user and design requirements.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Analyze game specifications	1.1. ***Design documentation*** is obtained and the requirements for the game are reviewed and clarified based on enterprise standards. 1.2. Game technical design is conceptualized based on client requirements. 1.3. Program scope and limits are identified/clarified based on project requirements.
2. Analyze game physics	2.1. Identify & Solve physics problems/equations based on GDD. 2.2. Determine maximum and/or minimum values, sketch curves, and determine the range for a given domain based on identified physics problem based on enterprise standards. 2.3. Convert physics formulas from mathematical notations into syntax based on GDD. 2.4. Apply ***differentiation*** based on GDD.
3. Prepare technical game documentation	3.1. ***Requirements*** are transformed to technical design document (TDD) according to ***enterprise standards***. 3.2. Program structures are illustrated based on game design document. 3.3. Special routines or procedures are identified and documented based on project requirements 3.4. ***Resources for coding and testing programs*** are identified based on project requirements.
4. Validate the technical game documentation	4.1. Technical design document is checked for compliance with enterprise documentation standards 4.2. Technical design document is checked based on project specifications 4.3. Past project documentations are reviewed for comparison with the technical design document.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Design documentation	• Game design document (GDD) • Technical design document (TDD)
2. Differentiation	• Gradients • Tangents • Normal • Stationary points • Rates of change
3. Requirements	• Data types • Variables
4. Enterprise standards	• Code templates • Platform-specific templates, e.g., Android templates • Naming conventions
5. Resources for coding and testing programs	• Personnel • Hardware • Software

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Technical game documentation is prepared 1.2 Technical game documentation is validated 1.3 Game program logic is formulated/designed
2. Required Knowledge and Attitude	2.1 Mathematical and science concepts to : - Solve spatial problems in 2D and 3D - Simulate movement (objects) - Precision of movement (objects) 2.2 Game logic design using construct/modules/ objects 2.3 Concepts of various game program design and system lifecycle options 2.4 Game system specifications and requirements 2.5 Learning from multiple sources 2.6 Researching using library and printed literature 2.7 Understanding the expectation 2.8 Organizing your thoughts 2.9 Organizing projects
3. Required Skills	3.1 Applying the use of various design documentation tools 3.2 Conceptualizing game technical design 3.3 Designing and validating program logic and flow 3.4 Combine applicable game programming languages 3.5 Using the search engines 3.6 Understanding key terminology 3.7 Draft a mind map 3.8 Task Allocation
4. Resource Implications	To demonstrate this unit of competence the following resources will be required: 4.1 Program or design specifications 4.2 Documentation tools 4.3 Personal computer or workstation
5. Methods of Assessment	Competency may be assessed through: 5.1 Observation of real or simulated work processes 5.2 Individual demonstration with oral questioning 5.3 Practical exam 5.4 Portfolio assessment of work samples
6. Context of Assessment	6.1 Competency may be assessed in the workplace or in a simulated work environment.

UNIT TITLE : **APPLY OBJECT-ORIENTED PROGRAMMING LANGUAGE SKILLS**

UNIT CODE : **ICT 313354**

UNIT DESCRIPTOR : This unit defines the knowledge, skills and attitudes required to create Object-Oriented (OO) program. Competence includes applying basic language syntax and layout, applying basic OO principles in writing codes, testing and debugging codes and documenting activities.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Apply basic language syntax and layout	1.1. Basic ***language*** syntax rules and best practices are followed 1.2. Language data-types, operators and expressions are used in accordance with game-code standards 1.3. The appropriate language syntax for sequence, selection and iteration constructs is used and customized to achieve robust efficient code
2. Apply basic OO principles in the target language	2.1. A class that contains primitive member/instance variables is implemented 2.2. A class that contains multiple options for object construction is implemented 2.3. Enforce class security using encapsulation 2.4. Inheritance is implemented to at least 2 levels of depth 2.5. Polymorphism is used at a simple level through inheritance to enable easy code extension
3. Debug code	3.1. An ***integrated development environment*** is used, particularly the language debugging facilities 3.2. Program debugging techniques are used to detect and resolve errors
4. Document activities	4.1. Guidelines for developing maintainable code adhering to a set of coding standard is followed 4.2. Internal documentation standards and tools are followed and used
5. Test code	5.1. Simple tests are developed and conducted to confirm the coding process meets design specification 5.2. The tests performed are documented 5.3. Corrections are made to the code and the documentation as needed

RANGE OF VARIABLES

VARIABLE	RANGE
1. Language	May include but not limited: • Java • C++ • C#
2. Integrated development environment	May include but not limited: • Visual C++ • Visual Studio Suite • Eclipse • J-Edit • Code Warrior • Jbuilder

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Basic language syntax and layout is applied 1.2 Basic object-oriented principles in the target languages is applied 1.3 Codes are debugged and tested
2. Required Knowledge and Attitude	2.1 Understanding of Object oriented programming concepts 2.2 Object oriented programming language 2.3 Small size application development 2.4 Using a GUI to interact with operator 2.5 Learning from multiple sources 2.6 Problem solving 2.7 Coping with stress 2.8 Time management
3. Required Skills	3.1 Reading and interpreting program specifications, translating requirements from problem space to machine space 3.2 Integrated Development environment usage 3.3 Programming techniques 3.4 Internal (code) documentation techniques 3.5 Testing and debugging techniques 3.6 Documentation techniques 3.7 Combine applicable game programming languages 3.8 Decision making process 3.9 Setting realistic goals 3.10 Develop a time frame for the project
4. Resource Implications	To demonstrate this unit of competence the following resources will be required: 4.1 Programming language and development environment 4.2 User requirements and specification 4.3 Program and documentation standards 4.4 Personal computer or workstation
5. Methods of Assessment	Competency may be assessed through: 5.1 Observation of real or simulated work processes 5.2 Individual demonstration with oral questioning 5.3 Practical exam 5.4 Portfolio assessment of work samples
6. Context of Assessment	6.1 Competency may be assessed in the workplace or in a simulated work environment.

UNIT TITLE : **APPLY PROGRAMMING SKILLS FOR IN-GAME APPLICATION**

UNIT CODE : **ICT 313353**

UNIT DESCRIPTOR : This unit defines the knowledge, skills and attitudes required to undertake game-programming tasks using a programming language. Competence includes development environment preparation, basic language syntax and layout application, game-related principles application, assets integration as well as debugging and testing techniques in support of the programming activity.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Analyze TDD	1.1. ***Game Mechanics*** are obtained by analyzing the GDD and TDD. 1.2. Technical Storyboard and its corresponding pseudo code are derived from the GDD and TDD. 1.3. Necessary ***hardware/software*** is set up to code, compile and run according to development environment requirements. 1.4. Source code control is set up according to company requirements.
2. Apply basic language syntax and layout	2.1 Basic ***language*** syntax rules and best practices are observed based on enterprise standards. 2.2 Language data types, operators and expressions are optimized and used in accordance with game-code standards. 2.3 Language syntax for sequence, selection and iteration constructs are used and customized to achieve robust efficient code.
3. Develop working prototype	3.1. Game module is identified per iteration in line with enterprise policies. 3.2. Game Loop is defined and explained in line with key concept and target platform. 3.3. Program code is created and implemented in accordance with specifications for the game module in the technical design document (TDD). 3.4. ***Mathematical concepts and techniques*** are used in controlling and implementing ***game systems.*** 3.5. ***Style and design principles*** are used to solve common game programming problems. 3.6. ***Data structures*** and ***algorithms*** are used and customized to ensure robust and fast implementation of game systems. 3.7. Appropriate ***design patterns*** are identified and applied in coming up with initial prototype. 3.8. Integrate and review different ***assets*** based on the GDD and TDD.

4. Test prototype	4.1. Execute the prototype and check workability. 4.2. Prototype is evaluated based on GDD. 4.3. Prototype iteration is applied based on evaluation results. 4.4. Improvements and any lessons learned and possible recommendations are incorporated in prototype and documented. 4.5. Iterative prototyping cycle is implemented until game final prototype is approved in accordance with enterprise policies.
5. Refine/Debug system	5.1. Game prototype is referred to ***game quality assurance (QA)/testing techniques*** for user-acceptability testing. 5.2. Program errors identified are addressed and fixed in accordance with quality standards. 5.3. Overall ***game design concerns*** including usability and accessibility issues are addressed based on game quality assurance (QA)/testing techniques. 5.4. Game program is optimized based on project requirements.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Game Mechanics	May include but not limited: • Gameplay • Character behavior • Collusion Specification • Game Progression • Rules • Limitations • Options • User Interaction • Game Systems
2. Hardware	• Windows PC • Mac • Linux - Ubuntu
3. Software (IDE)	This may be any of the following languages, but are not limited: • Visual Studio - Express - Professional • Eclipse • Unity 3D - Basic - Pro • Flash • Game engines - Unreal - Cry Engine
4. Language	This may be any of the following languages, but not limited: • C / C++ • C# • Java • Python • ActionScript
5. Mathematical concepts and techniques	• Linear algebra - Vectors and matrices - Coordinate spaces and transformations • Geometry - Conic sections - Equation of a line

	• Basic trigonometry - Angles - Primary Trigonometric Functions • Basic Differential Calculus - Limits - Polynomial differentiation - Basic integration • Basic Newtonian physics - Projectile motion • Collision detection • Discrete math
6. Game systems	• Graphics • Inputs • Gameplay • Physics • Basic artificial intelligence (flee and chase) • Sound
7. Style and design principles	May include but not limited: • Object-oriented programming paradigm - Polymorphism - Inheritance - Interfaces • Design patterns - Singleton - Observer Pattern - Visitor Pattern - Template Pattern - Bridge or Strategy Pattern
8. Data structures	May include but not limited: • List - Arrays - Linked Lists • Stacks • Queue • Trees • Graphs • Vectors
9. Algorithms	May include but not limited: • Searching • Sorting • Broad-Phase Collision Test

10. Design patterns	May include but not limited: • Singleton • Observer Pattern • Visitor Pattern • Template Pattern • Bridge or Strategy Pattern
11. Assets	May include but are not limited: • Art • Animation • Sound
12. Design patterns	This refers to generally accepted style and design principles such as: • Object-oriented design patterns • Game-design patterns
13. Game quality assurance (QA)/testing techniques	May include but not limited to : • Pair programming • Focus group discussion (FGD) • Arcade testing with forms
14. Game-design concerns	May include but not limited to : • Game objects and setting • Game rules and dynamics • Play mechanics • Game goals • Theme/color

EVIDENCE GUIDE

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Game development environment is prepared 1.2 Code for game application is written 1.3 Game application or programs is executed and tested
2. Required Knowledge and Attitude	2.1 Basic interface design; use of GUIs for human-computer interaction 2.2 Mathematical concepts and techniques 2.3 Controlling and implementing game systems 2.4 Style and design principles 2.5 Integrated development environment 2.6 Data structures and algorithms 2.7 Program debugging techniques 2.8 Language data-types, operators and expressions 2.9 Approaches to writing or developing game applications/programs 2.10 Knowledge of various documentation tools 2.11 Platforms/Game engines 2.12 Knowledge In Completing a Game with Game Loop 2.13 Language syntax 2.13.1. Variable setting 2.13.2. Arithmetic and logic operations 2.13.3. Conditions 2.13.4. Loop and branch
3. Required Skills	3.1 Reading and interpreting program specifications, translating requirements from problem space to machine space 3.2 Using Integrated Development Environment (IDE) 3.3 Programming techniques 3.4 Internal (code) documentation techniques 3.5 Testing and debugging techniques 3.6 Documentation techniques 3.7 Planning various programming activities 3.8 Programming in a team environment 3.9 Preparing program documentation 3.10 Interpreting program specifications and user requirements 3.11 Programming a Functional Game-Application with a Game Loop

4. Resource Implications	To demonstrate this unit of competence the following resources will be required: 4.1 Programming language and development environment 4.2 User requirements and specifications 4.3 Program and documentation standards 4.4 Personal computer or workstation 4.5 Programming standards - GDD/TDD for a specific game project 4.6 Documentation standards and tools 4.7 Personal computer or workstation with game-development tools
5. Methods of Assessment	Competency may be assessed through: 5.1 Observation of real or simulated work processes 5.2 Individual demonstration with oral questioning 5.3 Practical exam 5.4 Game portfolio assessment of work samples
6. Context of Assessment	6.1 Competency may be assessed in the workplace or in a simulated work environment.

SECTION 3 TRAINING STANDARDS

3.1 CURRICULUM DESIGN

Course Title: Game Programming **NC Level:** NC III

Nominal Training Duration:

64 hrs.	- Basic Competencies
70 hrs.	- Common Competencies
1,100 hrs.	- Core Competencies
1,234 hrs.	

Course Description:

This course is designed to develop & enhance the knowledge, skills, & attitudes of a Game Programmer in accordance with industry standards. It covers the basic & common competencies in addition to the core competencies such as designing game program logic, applying object-oriented programming language skills and applying programming skills for in-game application. The nominal duration of **800 hours** training hours covers the required core units at Game Programming NC III and an additional **300 hours** supervised-industry training (SIT). TVET providers can however, offer a longer, ladderized course covering the NC III basic, common, and core units.

BASIC COMPETENCIES
64 hrs.

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Lead workplace communication	1.1 Communicate information about workplace processes. 1.2 Lead workplace discussions. 1.3 Identify and communicate issues arising in the workplace	• Group discussion • Role Play • Brainstorming	• Observation • Interviews
2. Lead small teams	2.1 Provide team leadership. 2.2 Assign responsibilities among members. 2.3 Set performance expectation for team members. 2.4 Supervise team performance	• Lecture • Demonstration • Self-paced (modular)	• Demonstration • Case studies

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
3. Develop and practice negotiation skills	3.1 Identify relevant information in planning negotiations 3.2 Participate in negotiations 3.3 Document areas for agreement	• Direct observation • Simulation/role playing • Case studies	• Written test • Practical/ performance test
4. Solve workplace problem related to work activities	4.1 Explain the analytical techniques. 4.2 Identify the problem. 4.3 Determine the possible cause/s of the problem.	• Direct observation • Simulation/role playing • Case studies	• Written test • Practical/ performance test
5. Use mathematical concepts and techniques	5.1 Identify mathematical tools and techniques to solve problem 5.2 Apply mathematical procedures/solution 5.3 Analyze results	• Direct observation • Simulation/role playing • Case studies	• Written test • Practical/ performance test
6. Use relevant technologies	6.1 Identify appropriate technology 6.2 Apply relevant technology 6.3 Maintain/enhance relevant technology	• Direct observation • Simulation/role playing • Case studies	• Written test • Practical/ performance test

COMMON COMPETENCIES
70 hrs.

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Apply critical thinking and thought organization	1.1 Identify the theoretical foundations of critical thinking 1.2 Develop constructive arguments 1.3 Apply methods of reasoning 1.4 Affirm generalization 1.5 Arrive at a conclusion	▪ Field trip ▪ Symposium ▪ Film showing ▪ Simulation ▪ Supervised industry training	▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report
2. Apply Quality Standards	2.1 Asses quality of received materials 2.2 Assess own work 2.3 Engage in quality improvement	▪ Field trip ▪ Symposium ▪ Film showing ▪ Simulation ▪ Supervised industry training	▪ Demonstration & questioning ▪ Observation & questioning ▪ Third party report
3. Perform computer operations	3.1 Set-up workstation 3.2 Prepare storage media 3.3 Work with files and objects 3.4 Manipulate word processing software 3.5 Manipulate spreadsheet software 3.6 Manipulate customize and database applications 3.7 Utilize the internet 3.8 Maintain computer hardware and software	▪ Modular ▪ Film showing ▪ Computer based training (e-learning) ▪ Project method ▪ Supervised industry training	▪ Demonstration and questioning ▪ Observation and questioning ▪ Third party report ▪ Assessment of output product ▪ Portfolio ▪ Computer based assessment

CORE COMPETENCIES
1,100 hrs.

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Design game program logic 200 hrs	1.1. Analyze game specifications 1.2. Analyze game physics 1.3. Prepare technical game documentation 1.4. Validate the technical game documentation	• Lecture/ Discussion • Hands on • Exercises • Demonstration • Supervised industry training	• Demonstration / Practical exam • Presentation with questioning • Portfolio of work samples • Individual interview
2. Apply object-oriented programming language skills 200 HRS	2.1. Apply basic language syntax and layout 2.2. Apply basic OO principles in the target language 2.3. Debug code Document activities 2.4. Test code	• Lecture/ Discussion • Hands on • Exercises • Demonstration • Supervised industry training	• Demonstration / Practical exam • Presentation with questioning • Portfolio of work samples • Individual interview
3. Apply programming skills for in-game application 400 hrs	3.1. Apply basic language Analyze TDD 3.2. Apply basic language syntax and layout 3.3. Develop working prototype 3.4. Test prototype 3.5. Refine/Debug system	• Lecture/ Discussion • Hands on • Exercises • Demonstration • Supervised industry training	• Demonstration / Practical exam • Presentation with questioning • Individual interview • Game Portfolio of work samples

Note: The Supervised Industry Training (SIT) component may be implemented in flexible manner. It may be integrated within various modules or units of competency or at the end of the in-school or classroom training.

3.2 TRAINING DELIVERY

The delivery of training shall adhere to the design of the curriculum. Delivery shall be guided by the 10 basic principles of competency-based TVET.

- The training is based on curriculum developed from the competency standards;
- Learning is modular in its structure;
- Training delivery is learner-centered and should accommodate individualized and self-paced learning strategies;
- Training is based on work that must be performed;
- Training materials are directly related to the competency standards and the curriculum modules;
- Assessment is based in the collection of evidence of the performance of work to the industry required standard;
- Training is based on both on- and off-the-job components
- Training program allows for recognition of prior learning (RPL) or current competencies;
- Training allows for multiple entry and exit; and
- Training programs are registered with the UTPRAS.

The competency-based TVET system recognizes various types of delivery modes, both on and off-the-job as long as the learning is driven by the competency standards specified by the industry. The following training modalities may be adopted when designing training programs:

- The dualized mode of training delivery is preferred and recommended. Thus programs would contain both in - school and in-industry training or fieldwork components. Details can be referred to the Dual Training System (DTS) Implementing Rules and Regulations.
- Modular/self-paced learning is a competency-based training modality wherein the trainee is allowed to progress at his own pace. The trainer just facilitates the training delivery.
- Peer teaching/mentoring is a training modality wherein fast learners are given the opportunity to assist the slow learners.
- Supervised industry training or on-the-job training is an approach in training designed to enhance the knowledge and skills of the trainee through actual experience in the workplace to acquire specific competencies prescribed in the training regulations.
- Distance learning is a formal education process in which majority of the instruction occurs when the students and instructor are not in the same place. Distance learning may employ correspondence study, or audio, video or computer technologies.
- Project-based instruction is an authentic instructional model or strategy in which students plan, implement and evaluate projects that have real world applications.

3.3 TRAINEE ENTRY REQUIREMENTS

The trainees who wish to enter the course should possess the following requirements:

- High school in level and/or holder of HS diploma or equivalent.
- With Skill Functions which will be validated by an entrance exam to be administered by the training institution using a tool devised by the Technical Experts Panel (TEP) and participants of the National Validation of this Training Regulation.
- Knowledge of at least one (1) programming language is a preference
- Has the capacity to communicate in both oral and written forms.
- Physically able to manipulate a mouse, track-ball, electronic pen, etc.
- Must have knowledge of video/computer games in any platform.

This list does not include specific institutional requirements such as educational attainment, appropriate work experience and others that may be required from the trainees by the school or training center delivering the TVET program.

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS

Recommended list of tools, equipment and materials for the conduct of training for **10** trainees in Game Programming NC III:

TOOLS		EQUIPMENT		MATERIALS	
Qty	**Description**	**Qty**	**Description**	**Qty**	**Description**
10 licenses	Computer Application *Require At least 2 - Visual Studio .NET - Professional - Flash - Eclipse - Unity 3D - Game engines	10	Computer (with peripherals) Windows PC or Mac - 17in. LCD monitor, - multi-core 2GHz CPU, - Direct X10 capable video card, - 4GB memory, - 500 GB hard disk,	10	Hand-outs
10 licenses	Graphics Library e.g. - DirectX	10	Ergonomic computer tables and chairs	10	Learning materials/ guide
1	Internet access , 2Mbps	1	LCD Projector and screen	10	Practice materials
		1	Printer	10	Reference books
		1	White board and / or glass board		

The quantity of tools and equipment to be used for the conduct of training for this qualification shall depend on the number of students, size of the class, and/or modality of training. The most important consideration is to make sure that tools and equipment are adequately provided to all trainees when needed. The actual list of tools, equipment,

machines, supplies and other materials to be used shall be identified and detailed in the Competency Based Curriculum (CBC) to be submitted by the TVET provider when registering a course or training program with TESDA.

Due to the fast-changing nature of the Information and Communications Technology (ICT) sector, TVET providers are reminded to use and provide their trainees with the latest technology tools/software, equipment and materials where appropriate and applicable.

In cases where there are specialized tools, equipment and facilities that are not generally considered standard requirements or not absolute requisites for training, the industry working group or TESDA may provide guidelines or specific advice on such matters.

3.5 TRAINING FACILITIES

Based on class size of 10 students/trainees the space requirements for the teaching/learning and circulation areas are as follows:

TEACHING/LEARNING AREAS	SIZE IN METERS	AREA IN SQ. METERS	QTY	TOTAL AREA IN SQ. METERS
Lecture Area (optional)	5 x 8	40	1	40
Computer/Laboratory Area	6 x 8	48	1	48
Learning Resource Area	4 x 5	20	1	20
Wash ,Toilet & Locker Room	2 x 5	10	2	20
Sub-Total				**128**
Facilities/Equipment/Circulation**				38
Total Area				**166**

***** Area requirement is equivalent to 30% of the total teaching/learning areas***

Appropriate consideration should be given in providing and allocating work space, communications facilities, and the usual workplace amenities to ensure a proper learning environment. Where applicable, training shall be held or conducted in learning facilities in accordance with generally accepted industry standards and practice.

3.6 TRAINERS' QUALIFICATIONS

- Holder of National TVET Trainer's Certificate (NTTC) Level 1
- * Must have at least 2-years relevant industry experience.
- Must be physically & mentally fit.

* Optional: Only when required by the hiring institution.

3.7 INSTITUTIONAL ASSESSMENT

Institutional Assessment is undertaken by trainees to determine their achievement of units of competency. A certificate of achievement may be issued for each unit of competency.

As a matter of policy, graduates of programs registered with TESDA under these training regulations are required to undergo mandatory national competency assessment upon completion of the program.

SECTION 4: NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

4.1 To attain the National Qualification of **Game Programming NC III**, the candidate must demonstrate competence as described in sub-section 4.2.1 of this Training Regulations. Successful candidates shall be awarded a National Certificate signed by the TESDA Director-General.

4.2 The qualification of **Game Programming NC III** may be attained through demonstration of competence through a single comprehensive project-type assessment covering all required units of competency of the qualification:

4.2.1 APPLYING GAME PROGRAMMING SKILLS

- Design game program logic
- Apply object-oriented programming language skills
- Apply programming skills for in-game application

4.3 Assessment shall focus on the core units of competency. The basic and common units shall be integrated or assessed concurrently with the core units.

4.4 The following are qualified to apply for assessment and certification:

4.4.1. Graduate of formal, non-formal, and informal, including enterprise-based, training programs.

4.4.2. Experienced workers (wage employed or self employed)

4.5 The guidelines on assessment and certification are discussed in detail in the "Procedures Manual on Assessment and Certification" and "Guidelines on the Implementation of the Philippine TVET Qualification and Certification System (PTQCS)".

ANNEX A. ICT COMPETENCY MAP

GAME PROGRAMMING NC III

BASIC COMPETENCIES

Receive And Respond To Workplace Communication	Work With Others	Demonstrate Work Values	Practice Basic Housekeeping Procedures	Participate In Workplace Communication
Work In A Team Environment	Practice Career Professionalism	Practice Occupational Health And Safety Procedures	**Lead Workplace Communication**	**Lead Small Team**
Develop And Practice Negotiation Skills	**Solve Problems Related To Work Activities**	**Use Mathematical Concepts And Techniques**	**Use Relevant Technologies**	Utilize Specialist Communication Skills
Develop Team And Individuals	Apply Problem Solving Techniques In The Workplace	Collect, Analyze And Organize Information	Plan And Organize Work	Promote Environmental Protection

COMMON COMPETENCIES

Apply Critical Thinking And Proper Thought Organization	**Apply Quality Standards**	**Perform Computer Operations**

CORE COMPETENCIES

Communicate Effectively In A Customer Contact Center	Render Quality Customer Service	Utilize Enterprise/ Company Technology	Conduct Contact Center Campaign	Provide Specialized Support And Assistance To Customers
Lead A Contact Center Work Team	Manage The Activities Of A Contact Center Work Team	Use Business Technology	Use Medical Technology To Carry Out Task	Produce Text From Audio Transcription
Review/Edit Documents	Produce Key Drawings For Animation	Produce Cleaned-Up And In-Betweened Drawings	Create 2d Digital Animation	Use An Authoring Tool To Create An Interactive Sequence
Use 2d Digital Animation Software	Build Library Of Objects	Build Scenes And Assets	Produce 2d Digital Animation Movies & Animated Movie Clips	Create 3d Digital Animation
Coordinate The Production Of Animation	Produce Storyboard For Animation	Produce Background Designs	Composite And Edit Animation Sequence	Produce Over-All Designs For Animation
Design Game Program Logic	**Apply Object-Oriented Program Language Skills**	**Apply Programming Skills For In-Game Application**	Manage The Activities Of A Work Team	Lead A Team In Delivering Quality Service
Design Program Logic	Apply Program Development Approach	Apply Programming Skills In A Second Language		

DEFINITION OF TERMS

GENERAL

1) **Certification -** is the process of verifying and validating the competencies of a person through assessment

2) **Certificate of Competency (COC)** - is a certification issued to individuals who pass the assessment for a single unit or cluster of units of competency

3) **Common Competencies** - are the skills and knowledge needed by all people working in a particular industry

4) **Competency** - is the possession and application of knowledge, skills and attitudes to perform work activities to the standard expected in the workplace

5) **Competency Assessment -** is the process of collecting evidence and making judgments on whether competency has been achieved

6) **Competency Standard (CS)** - is the industry-determined specification of competencies required for effective work performance

7) **Context of Assessment** - refers to the place where assessment is to be conducted or carried out

8) **Core Competencies - are** the specific skills and knowledge needed in a particular area of work - industry sector/occupation/job role

9) **Critical aspects of competency -** refers to the evidence that is essential for successful performance of the unit of competency

10) **Elective Competencies -** are the additional skills and knowledge required by the individual or enterprise for work

11) **Elements** - are the building blocks of a unit of competency. They describe in outcome terms the functions that a person perform in the workplace

12) **Evidence Guide** - is a component of the unit of competency that defines or identifies the evidences required to determine the competence of the individual. It provides information on critical aspects of competency, required knowledge, required skills, resource implications, assessment method and context of assessment

13) **Level -** refers to the category of skills and knowledge required to do a job

14) **Method of Assessment** - refers to the ways of collecting evidence and when evidence should be collected

15) **National Certificate (NC)** - is a certification issued to individuals who achieve all the required units of competency for a national qualification defined under the Training Regulations. NCs are aligned to specific levels within the PTQF

16) **Performance Criteria** - are evaluative statements that specify what is to be assessed and the required level of performance

17) **Qualification** - is a cluster of units of competencies that meets job roles and is significant in the workplace. It is also a certification awarded to a person on successful completion of a course in recognition of having demonstrated competencies in an industry sector

18) **Range of Variables** - describes the circumstances or context in which the work is to be performed

19) **Recognition of Prior Learning (RPL)** - is the acknowledgement of an individual's skills, knowledge and attitudes gained from life and work experiences outside registered training programs

20) **Resource Implications** - refers to the resources needed for the successful performance of the work activity described in the unit of competency. It includes work environment and conditions, materials, tools and equipment

21) **Basic Competencies -** are the skills and knowledge that everyone needs for work

22) **Training Regulations (TR)** - refers to the document promulgated and issued by TESDA consisting of competency standards, national qualifications and training guidelines for specific sectors/occupations. The TR serves as basis for establishment of qualification and certification under the PTQF. It also serves as guide for development of competency-based curricula and instructional materials including registration of TVET programs offered by TVET providers

23) **Required Knowledge -** refers to the competency that involves in applying knowledge to perform work activities. It includes specific knowledge that is essential to the performance of the competency

24) **Required Skills** - refers to the list of the skills needed to achieve the elements and performance criteria in the unit of competency. It includes generic and industry specific skills

25) **Unit of Competency** - is a component of the competency standards stating a specific key function or role in a particular job or occupation; it is the smallest component of achievement that can be assessed and certified under the PTQF

SECTOR SPECIFIC

1. **Algorithm** - is a type of effective method in which a list of well-defined instructions for completing a task will, when given an initial state, proceed through a well-defined series of successive states, eventually terminating in an end-state. The transition from one state to the next is not necessarily deterministic; some algorithms, known as probabilistic algorithms, incorporate randomness.
2. **Artificial intelligence programmer** - develops the logic the game uses to carry out a large number of actions. An AI programmer may program pathfinding, strategy and enemy tactic systems. This is one of the most challenging aspects of game programming and its sophistication is developing rapidly.
3. **Browser** - a software package that provides the user interface for accessing Internet, intranet and extranet Web sites.
4. **Compiler** - is a computer program (or set of programs) that translates text written in a computer language (the source language) into another computer language (the target language). The original sequence is usually called the source code and the output called object code. Commonly the output has a form suitable for processing by other programs (e.g., a linker), but it may be a human-readable text file.

5. **Computer** - a device that has the ability to accept data; internally store and execute a program of instructions; perform mathematical, logical, and manipulative operations on data; and report the results.
6. **Computer Terminal -** any input/output device connected by telecommunications links to a computer.
7. **Data** - objective measurements of the attributes (characteristics) of entities such as people, places, things, and events.
8. **Documentation** - a collection of documents or information.
9. **Eclipse** - is an integrated development environment (IDE) written primarily in Java. The initial codebase originated from Visual Age. In its default form it is meant for Java developers, consisting of the Java Development Tools (JDT). Users can extend its capabilities by installing plug-ins written for the Eclipse software framework, such as development toolkits for other programming languages, and can write and contribute their own plug-in modules.
10. **Edit -** to modify the form or format of data
11. **Encryption** - to scramble data or convert it, prior to transmission, to a secret code that masks the meaning of he data to unauthorized recipients.
12. **End user -** anyone who uses an information system or the information it produces.
13. **Ergonomics** - the science and technology emphasizing the safety, comfort, and ease of use of human-operated machines. The goal of ergonomics is to produce systems that are user-friendly: safe, comfortable and easy to use.
14. **Flash** - can manipulate vector and raster graphics and supports bi-directional streaming of audio and video. It contains a scripting language called ActionScript. It is available in most common web browsers and some mobile phones and other electronic devices (using Flash Lite). Several software products, systems, and devices are able to create or display Flash, including the Adobe Flash Player. The Adobe Flash Professional multimedia authoring program is used to create content for the Adobe Engagement Platform, such as web applications, games and movies, and content for mobile phones and other embedded devices.
15. **Game programming** - a subset of game development, is the programming of computer, console or arcade games. Though often engaged in by professional game programmers, many novices may program games as a hobby.
16. **Game loop** - the key component of any game, from a programming standpoint. The game loop allows the game to run smoothly regardless of a user's input or lack thereof.
17. **Game programmer** - is a programmer who primarily develops video games or related software (such as game development tools). Game programming has many specialized disciplines; practitioners of any may regard themselves as "game programmers". A game programmer should not be confused with a game designer; many designers are also programmers, but not all are, and it is rare for one person to serve both roles in modern professional games
18. **Graphics programmer** - historically, this title usually belonged to a programmer who developed specialized blitter algorithms and clever optimizations for 2D graphics. Today, however, it is almost exclusively applied to programmers who specialize in developing and modifying complex 3D graphic renderers. Some 2D graphics skills have just recently become useful again, though, for developing games for the new generation of cell phones, PDAs and handheld game consoles. A 3D graphics programmer must have a firm grasp on advanced mathematical concepts such as vector and matrix math, quaternions and linear algebra.

19. **Game physics programmer** - is dedicated to developing the physics a game will employ. Typically, a game will only simulate a few aspects of real-world physics. For example, a space game may need simulated gravity, but would not have any need for simulating water viscosity.
20. **Gameplay programmer -** Though all programmers add to the content and experience that a game provides, a gameplay programmer focuses more on a game's strategy and the "feel" of a game. This is usually not a separate discipline, as what this programmer does usually differs from game to game, and they will inevitably be involved with more specialized areas of the game's development such as graphics or sound.
21. **Information** - data placed in a meaningful and useful context for an end user.
22. **Information and Communication Technology (ICT) -** refers to technologies associated with the transmission and exchange of data in the form of sound, text, visual images, signals or any combination of those forms through the use of digital technology. It encompasses such services as telecommunications, posts, multimedia, electronic commerce, broadcasting, and information technology.
23. **Integrated development environment (IDE)** - is a software application that provides comprehensive facilities to computer programmers for software development. An IDE normally consists of a source code editor, a compiler and/or interpreter, build automation tools, and (usually) a debugger. Typically an IDE is dedicated to a specific programming language, so as to provide a feature set which most closely matches the programming paradigms of the language. However, some multiple-language IDEs are in use, such as Eclipse, ActiveState Komodo, recent versions of NetBeans, and Microsoft Visual Studio.
24. **Key frame** - is a single still image in an animated sequence that occurs at an important point in that sequence; key frames are defined throughout an animated sequence, in order to define pivotal points of motion before the frames in between are drawn or otherwise created to "tween" the motion between the two key frames.
25. **Local Area Network (LAN) -** a communications network that typically connects computers, terminals, and other computerized devices within a limited physical area such as an office, building, manufacturing plant and other work sites.
26. **Microsoft DirectX** - is a collection of application programming interfaces (APIs) for handling tasks related to multimedia, especially game programming and video, on Microsoft platforms.
27. **Object code** - or an object file, is the representation of code that a compiler or assembler generates by processing a source code file. Object files contain compact code, often called "binaries". A linker is typically used to generate an executable or library by linking object files together. The only essential element in an object file is machine code (code directly executed by a computer's CPU). Object files for embedded systems might contain nothing but machine code. However, object files often also contain data for use by the code at runtime, relocation information, program symbols (names of variables and functions) for linking and/or debugging purposes, and other debugging information.
28. **Outsourcing -** turning over all or part of an organization's information systems operation to outside contractors, known as systems integrators or facilities management companies.
29. **Quality Assurance -** methods for ensuring that information systems are free from errors and fraud and provide information products of high quality.
30. **Production.** During production, programmers churn out a great deal of source code to create the game described in the game's design document. Along the way, the design document is modified to meet limitations or expanded to exploit new features. The design document is very much a "living document" much of whose life is dictated by programmer's schedules, talent and resourcefulness.

31. **Prototyping -** Writing prototypes of gameplay ideas and features is an important activity that allows programmers and game designers to experiment with different algorithms and usability scenarios for a game. A great deal of prototyping may take place during pre-production before the design document is complete and may, in fact, help determine what features the design specifies. Prototyping may also take place during active development to test new ideas as the game emerges.
32. **Simulation** - the process of imitating a real phenomenon with a set of mathematical formulas. Advanced computer programs can simulate weather conditions, chemical reactions, atomic reactions, even biological processes.
33. **Software -** computer programs and procedures concerned with the operation of an information system.
34. **Sound programmer -** Not always a separate discipline, sound programming has been a mainstay of game programming since the days of *Pong*. Most games make use of audio, and many have a full musical score. Computer audio games eschew graphics altogether and use sound as their primary feedback mechanism.
35. **Source code** - is the collection of files needed to convert from human-readable form to some kind of computer-executable form. The source code may be converted into an executable file by a compiler, or executed on the fly from the human readable form with the aid of an interpreter.
36. **Standards -** measures of performance developed to evaluate the progress of a system toward its objectives
37. **System -** an assembly of methods, procedures, or techniques unified by regulated interaction to form an organized whole
38. **Vector** - is a line or a movement defined by end-points or, essentially, the distance between point A and point B. Vectors can be used to calculate animated motion mathematically instead of through the use of manual key frames; vectors can also be used to define computer-animated shapes.
39. **Video game** - is a game that involves interaction with a user interface to generate visual feedback on a video device. The word *video* in *video game* traditionally referred to a raster display device. However, with the popular use of the term "video game", it now implies any type of display device. The electronic systems used to play video games are known as platforms; examples of these are personal computers and video game consoles. These platforms are broad in range, from large computers to small handheld devices. Specialized video games such as arcade games, while previously common, have gradually declined in use.
40. **User- friendly** - a characteristic of human-operated equipment and systems that makes them safe, comfortable, and easy to use.

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