

This test paper should be withdrawn from candidates after the examination and any follow-up discussion of marks/grades awarded. This is to ensure the 'sight unseen' status of this paper is maintained for your centre and other schools/colleges during the diet of prelim examinations in 2013/2014.

2013/2014 P&N Test Paper for

NATIONAL
QUALIFICATIONS

TIME ALLOWED:
2 HOURS 30 MINUTES

COMPUTING
HIGHER

Attempt **all** questions in Section I.

Attempt **all** questions in Section II.

Attempt **one** sub-section of Section III.

Part A Artificial Intelligence

Page 10

Questions 21 to 24

Part B Computer Networking

Page 14

Questions 25 to 27

Part C Multimedia Technology

Page 17

Questions 28 to 31

For the sub-section chosen, attempt **all** questions.

Read all questions carefully.

Do not write on the question paper.

Write as neatly as possible.

SECTION I

Attempt all questions in this section.

Marks

1. Represent the decimal number –121 as an 8 bit binary number. 1

2. Name the component in *floating point representation* that would be used to store the precision of the number being represented. 1

3. A *bit-mapped image* requires 124,865 bits of backing storage. Express these storage requirements as kilobytes, to **one** decimal place. 2

4. The *ALU* is used to perform arithmetic calculations.
 - (a) State **one** other function of the ALU. 1
 - (b) Where is data held while the ALU is accessing it? 1

5. Explain why a *client server network* is often regarded as being more secure than a *peer-to-peer network*. 1

6. Anti-virus software uses various techniques to detect viruses.
 State the name of the technique used in each of the cases described below:
 - (i) the anti-virus software searches for a **known** pattern of bits that has already been identified to be a virus; 1
 - (ii) a calculation is performed on key files to produce a number. This number is recalculated and if it has changed then there may be a virus present. 1

7. During the *fetch/execute cycle*:
 - (i) State the control line that is used. 1
 - (ii) State the bus used to identify the location of the data in memory. 1

8. Data storage compensates for differences in speed between computers and peripherals.
 This is achieved through *buffering* and *spooling*.
 - (a) Explain the difference between buffering and spooling. 2
 - (b) Compensation for differences in speed between the computer and peripherals is one function of an interface. State **two** other functions of an interface. 2

SECTION I (continued)

9. (a) Explain why a *Boolean variable* would have a lower storage requirement than an *integer variable*. 2
- (b) Explain how a Boolean variable could be used in a *linear search algorithm*. 1
10. Describe **one** difference between a *scripting language* and a *procedural language*. (Ensure you give a complete comparison for full marks.) 2
11. State **two** characteristics of programming code that improve *maintainability*. 2
12. A programmer is working as part of a team and is given a module to write. State **two** pieces of information he will need before he can start work on the module. 2
13. The lines of code below are from a small program.
1. likes(john,mary).
2. likes(claire,mary).
- (a) Identify the **type** of language used. 1
- (b) Explain in plain English the meaning of the first line of code. 1
14. One role of the *project manager* is to ensure that the project is within budget. State another role of the project manager. 1
15. Different types of translators may be used during the software development process.
- (a) Which type of translator is best to use at the *implementation stage* of the software development process? 1
- (b) (i) Which translator would offer the most efficient coding solution in terms of system performance? 1
- (ii) Explain your answer to (i) above. 1
- (30)**

[END OF SECTION I]

SECTION II

Attempt all questions in this section.

16. An office manager is considering replacing all of his office computers and has narrowed his search down to the system listed below.

Computer Specification	
Name:	Oracle-3
Processor:	AXD 64 bit, 1.7 GHz, dual-core
Operating System:	OS 9.1

- (a) Before purchasing the computers the manager must ensure that the computer chosen is compatible with his office’s existing software.
- (i) Which piece of documentation should he consult? **1**
- (ii) State **one** other compatibility consideration that he should check. **1**
- (b) The Oracle-3 has a dual-core processor. Explain, using technical detail, how this would improve the system performance of a computer compared to a single-core processor. **2**
- (c) (i) State **one processor characteristic** not listed which will affect overall system performance and explain how it impacts on this performance. **2**
- (ii) State **one** hardware feature **outwith** the processor that is not listed and explain how it will impact on the system performance. **2**
- (d) (i) How many possible memory locations can this computer theoretically address? **2**
- (ii) Explain why the computer is unlikely to achieve this limit. **1**

SECTION II (continued)

17. A national government office of patents has a *client server* network which can receive registrations of new patents from computers located in buildings throughout the country.
- (a) (i) State **one** reason why a *peer to peer* network would not be suitable in this situation. 1
- (ii) State **one** essential piece of hardware required for each client. 1
- (b) The main registration office has a server, four client stations and a hub, configured in a *star topology*.
- (i) Draw and label a diagram showing this configuration. 2
- (ii) Suggest a hardware change that would improve the LAN performance **and** explain how this improvement would be achieved. 2
- (iii) Suggest an alternative topology that would not require a hub. 1
- (c) Security is an issue for any computer network.
- (i) State **two** possible misuses that can occur in a network. 2
- (ii) Suggest **one** utility program that could be installed to prevent one of these types of network misuse. 1
- (iii) With reference to the above network, which **two** laws might be broken if someone gained unauthorised access to the data stored? 2
- (d) (i) Explain how a *web server* could be used on a network to improve the time taken for many people to access a website. 1
- (ii) Describe a situation where the web pages delivered using a web server may have incorrect information. 1
18. Christine transfers images from her mobile phone to her computer for editing using a *serial interface*.
- (a) Christine's phone uses *solid state storage*. State **one** reason, apart from the small physical size, why this type of storage is used on mobile devices. 1
- (b) State the function of the interface that is used to ensure that the images are not transferred before the computer is ready to receive them. 1
- (c) The images support 65,536 colours and are set to 5 megapixels. Calculate the raw storage requirements of each image. 2
- (d) Explain why the actual file size is likely to be smaller than your calculation above. 1

SECTION II (continued)

19. A school sports event is organised between four house groups. A program updates the scores and displays the overall position on a message board.

Each house group is awarded points for events, depending on the position of their competitors, as show below.

The total points for each house is then updated after each event.

Any house may score all points in an event if its competitors take all 3 places in that event.

Placing	Points awarded
1	4
2	2
3	1

Position	House	Total Points
1	Skye	15
2	Isla	12
3	Jura	8
4	Bute	6

- (a) Suggest a suitable data structure and type to store the total points. 2
- (b) After each event, a module in the program will be called three times to ask for the house in each position (1st, 2nd and 3rd). The house name is entered and the appropriate house total is updated.

1.1	get_event_results	in:	out:	//get first place
1.2	get_event_results	in:	out:	//get second place
1.3	get_event_results	in:	out:	//get third place

- (i) Complete the data flow for step 1.1 above. 2
- (ii) Suggest a suitable variable type to store the inputted house name. 1
- (iii) Will the variable be local or global? Explain your answer. 2
- (iv) Within the module *get_event_results* a conditional statement is used to allocate a variable called “points” to the value 4, 2, or 1.
Suggest an alternative solution and explain why it is more efficient in terms of system performance. 2
- (v) Explain why the naming of the module is inappropriate and suggest a more suitable alternative. 2

SECTION II (continued)**19. (continued)**

- (c) The message board displays an event's results as shown below. A string variable called "placing" is used to store the message which has been created using a string operation.

Skye-points-4
Skye-points-2
Bute-points-1

- (i) Explain why the module that displays the output would be inside the *get_event_results* module. **1**
- (ii) State the string operation that has been used to produce the message display. **1**
- (iii) Using a coding language with which you are familiar write the coding to produce the text in the variable "placing". **3**

[Turn over

SECTION II (continued)

20. A computing teacher is writing notes as a guide to good software development practice for his pupils.
- (a) Understanding the initial problem to be solved is described as “the most important part of the whole process.”
- (i) Identify the **two** participants who are involved in discussions to ensure that the development team fully understands the task at hand. **2**
- (ii) State the documentation which is produced once both parties have agreed on the scope of the task to be undertaken. **1**
- (iii) The client wants additional features to be added after the project is complete.
Explain who would be required to pay for these changes. **1**
- (b) The stages of the software development process features in the first section of the teacher’s notes.
- (i) Identify the third stage of the software development process and the documentation produced at this stage. **2**
- (ii) Explain why it is often necessary to revisit a previous stage of the software development process and state the term used to describe this revisiting. **2**
- (c) The benefits of using a module library are emphasised in the guide. One benefit stated is saving time on writing the code.
State another benefit to the programmer of using a module library. **1**
- (d) Testing is described in the guide as being *systemic* or *comprehensive*.
Explain how systematic testing is carried out. **2**
- (e) Some of the pupils are confused about the differences between *functions* and *procedures*.
Explain **one** difference between a function and a procedure. **2**
- (f) The guide explains the use of variables and mentions the ‘scope of a variable’.
Explain the meaning of the term ‘scope’ in relation to a variable. **1**
- (60)**

[END OF SECTION II]

SECTION III

Attempt ONE sub-section of Section III

Part A	Artificial Intelligence	Page 10	Questions 21 to 24
Part B	Computer Networking	Page 14	Questions 25 to 27
Part C	Multimedia Technology	Page 17	Questions 28 to 31

For the sub-section chosen, attempt *all* questions.

Section III

PART A—Artificial Intelligence

Attempt all questions.

21. Shown below is part of a knowledge base containing information about eligibility for free prescriptions.

- | | |
|---|---|
| 1. location(technology, block_a). | <i>The technology faculty is located in block A.</i> |
| 2. location(social_science, block_c). | <i>The social_science faculty is located in block C.</i> |
| 3. in_faculty(technical, technology). | <i>technical dept is part of the technology faculty.</i> |
| 4. in_faculty(computing, technology). | <i>computing dept is part of the technology faculty.</i> |
| 5. in_faculty(business_ed, social_science). | |
| 6. status(technology, accredited). | <i>The technology courses are accredited.</i> |
| 7. in_dept(mr_liddle, computing). | |
| 9. in_dept(mrs_jones, business_ed). | |
| 10. in_dept(mr_stevens, technical). | |
| 11. in_faculty (X,Y):- in_dept(X,Z), in_faculty(Z,Y). | <i>Person X is in faculty Y if Z is in department Y and person X is in faculty Z.</i> |
| 12. location(X,Y):- in_faculty(X,Z), location(Z,Y). | <i>Person X is in location Y if person X is in department Y and department Y is located at Z.</i> |
| 13. status(X,Z):- in_faculty(X,Y), status(Y,Z). | |

(a) State the output for the following queries.

- | | |
|---|----------|
| (i) ? in_faculty(computing, technology) | 1 |
| (ii) ? in_faculty(mr_stevens, X) | 1 |

(b) List the output from the following query:

- | | |
|--------------------------|----------|
| ? status(X, accredited). | 3 |
|--------------------------|----------|

(c) Trace the query above to the **third** solution. In your trace you should use the terms *instantiate*, *backtrack* and *sub-goal* correctly.

6

(d) The rule in line 11 calls itself in the second sub-goal. State the term used to describe this feature.

1

Section III

PART A—Artificial Intelligence (continued)

22. A company that sells tablet computers uses an expert system to give advice to customers regarding which tablet is ideally suited for them. It is essential that the user interface in such a system offers *justification* facilities.

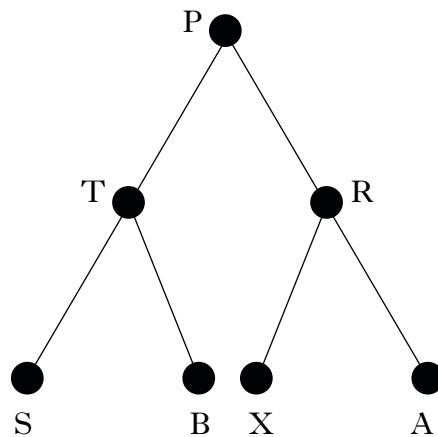
- (a) (i) A feature of justification is commonly known as ‘Why’. Describe how this feature is used during a consultation. 2
- (ii) State **one** other feature of justification and explain at which stage of the consultation process it is employed. 2

(b) What is the role of the sales staff while the expert system is being developed and at which stage of the software development cycle would they be employed? 2

(c) The *knowledge base* and the *inference engine* are two parts of an Expert System. State the purpose of each of these components. 2

(d) When searching a knowledge base, depth-first or breadth-first searches may be used.

Using the diagram below, where R is the goal, answer the following questions.



- (i) State the order of nodes visited in a breadth first search. 1
 - (ii) State the order of nodes visited in a depth first search. 1
 - (iii) Explain the difference between the memory requirements for each type of search. 1
- (e) Expert Systems have a restricted *domain*.
- (i) Explain the meaning of the term ‘restricted domain’ and why this is often necessary in most expert systems. 2
 - (ii) State **one** advantage that an expert system has over a human expert. 1

[Turn over

Section III

PART A—Artificial Intelligence (continued)

23. A new car navigation system uses Natural Language Processing, allowing the driver to input details by speech. A driver wants to plan a route in advance, avoiding toll roads. He says the following:

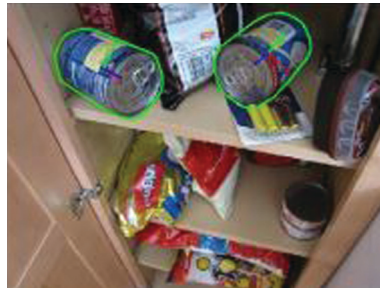
“I want to go from Glasgow to Newton Stewart, Castle Douglas and back, avoiding tolls.”

- | | |
|--|---|
| (a) At which stage of the NLP would the driver be involved? | 1 |
| (b) Identify two possible problems that the system might have with the above instruction. | 2 |
| (c) What term is used to describe situations involving sentences like the one above? | 1 |
| (d) Suggest an alternative sentence which might be better understood. | 3 |
| (e) The system is claimed to have artificial intelligence. | |
| (i) State two features of this system which are generally regarded as signs of intelligent behaviour. | 2 |
| (ii) State the name of a test that could be used to determine if the system is intelligent. | 1 |
| (iii) Describe the circumstances (in this context) of how the test would be set up and the people involved. | 2 |

Section III

PART A—Artificial Intelligence (continued)

24. A software company is developing a computer vision system that uses an artificial neural network to identify specific objects from a photograph. An example identifying drink cans in a cupboard is shown below.



- (a) (i) State the first stage involved in a computer vision system. 1
- (ii) Identify **one** possible problem encountered during this stage in the above example. 1
- (b) Explain how the system can separate different objects from each other in the image above and describe **one** difficulty which must have been overcome regarding the can on the right. 2
- (c) Explain in detail how the system was able to correctly identify the objects as cans. 2
- (d) (i) Compare programming in a procedural language to ‘programming’ an artificial neural system. 2
- (ii) Describe how the above artificial neural network was ‘programmed’. 2
- (e) The artificial neural system can be hard-wired or implemented as a software model.
- State **one** advantage of implementing an artificial neural system as a software model compared to being hard-wired. 2

(50)

[END OF SECTION III—PART A]

Section III

PART B—Computer Networking

Attempt all questions.

25. A small clothing company which specialises in safety equipment decides to sell its goods via the Internet. The company's website is

http://www.safetysafetyequipment.co.uk

As a result, it can pay less on wages and rent.

- (a) State **two** additional benefits to a company of trading via the Internet. 2
- (b) The company is allocated an IP address which is in the format 198.57.104.XXX.
- (i) What range of broadcast IP address are available to the company? 2
- (ii) Which class of IP has the company been allocated? 1
- (iii) Explain the relationship between the company's website URL and its IP address. 2
- (c) The website is created using HTML. The first three lines of coding for a page are shown:

```
<title>Welcome to Safety Equipment Online
<body>
<i><b>Be sure be safe buy from the best!!</i></b>
```

- Identify **two** errors present in this HTML code. 2
- (d) The company is keen to adapt its website so that it would be available to devices equipped with WAP technologies.
- (i) Describe **two** factors which the company should take into account when adapting the site for use with WAP technologies. 2
- (ii) *Wireless Mark-up Language* (WML) is used to produce Web content that can be read from WAP devices.
- Describe **two** ways in which WML differs from HTML. 2
- (e) Explain how staff at the clothing company may have been involved at the testing stage of the development of the website. 1

Section III**PART B—Computer Networking (continued)**

26. A local Council has installed an ‘Internet café’ in all of its libraries to allow free public access to both the Council’s Intranet and the wider Internet.
- (a) The librarians can download files to the network but the public cannot download any files.
- (i) Give **two** reasons why the local Council are keen to provide free Internet access to the public. 2
 - (ii) Explain how the network may be set up to allow the librarians to download files but not members of the public. 2
- (b) The Chief Librarian received a complaint from the parent of a child who accidentally accessed an inappropriate website. One of the librarians suggests a firewall should be installed.
- (i) Explain the purpose of a firewall and why a firewall would not help in this situation. 2
 - (ii) Suggest **two** alternatives which would restrict access to the Internet and recommend one as being the most suitable justifying your choice. 4
- (c) The network manager discovers that a member of staff has been using the Internet access for personal business which is against the Council’s policy. In extreme cases of abuse the police may become involved.
- (i) Explain the issues of personal confidentiality in relation to computer networks and why, in this case, the Council is in the right. 2
 - (ii) State the full name of the legislation that allows the Police to gather evidence when investigating Internet activity. 1
 - (iii) State **two** software actions that the police could use to investigate someone’s Internet activity. 2
- (d) Disaster avoidance strategies have been built into the council’s Intranet.
- (i) State **two** network disaster avoidance strategies. 2
 - (ii) A 4 Megabyte file is transferred across the network in 2 seconds. What is the transfer rate? Give your answer in megabits per second. 2

[Turn over

Section III**PART B—Computer Networking (continued)**

27. It is important that computer networks are designed to agreed standards, such as the Open Systems Interconnection (OSI).
- (a) State the name of the *layer* of the OSI model at which a *router* functions. 1
- (b) The CSMA/CD during the transmission of data is intended to improve the overall performance of networks but at times it can have the opposite effect.
- (i) Describe how CSMA/CD operates. 4
- (ii) Explain how CSMA/CD can improve network performance. 2
- (iii) Explain the meaning of the statement “at times it can have the opposite effect”. 2
- (iv) The byte of data below is transmitted across a network. It contains a *parity bit*.
- 1000 1111**
- State which kind of parity was used when sending this data. Justify your answer. 2
- (c) One possible method of data transfer is *asynchronous data transfer*.
- (i) Describe how asynchronous data transfer works on a network. 2
- (ii) Describe an overhead problem with asynchronous data transfer relating to the proportion of actual data bits which are sent in a stream. 2
- (iii) Suggest an alternative method of data transfer that does not have the same overhead issues and explain how the above issue is minimised. 2
- (50)**

[END OF SECTION III—PART B]

Section III

PART C—Multimedia Technology

Attempt all questions.

28. Bruce High School would like to make a promotional animation for all new S1 pupils about life in the school. They have a paper version of the school logo (shown below) which has to appear at the start of the animation.



- (a) Describe how a CCD in a scanner can create a digital version of the logo. Your answer should contain technical detail. 3

- (b) The edges of the scanned logo appear 'jagged', as shown below.



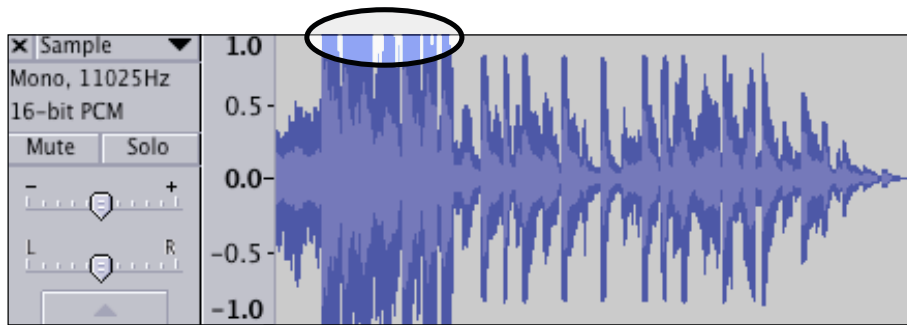
- (i) Suggest a **hardware** solution. 1
- (ii) Name and describe a **software** technique which might solve the problem. 2
- (c) Each frame in the completed 10 minutes video is held as a gif with a resolution of 640×480 pixels. The frame rate is 15 frames per second.
- (i) Calculate the file size of the video before compression. State your answer using appropriate units. Show all working. 3
- (ii) The animation is not smooth and appears to jump whenever there is movement. Suggest a setting which could be altered to solve this issue and explain the consequences of taking this action. 2
- (d) Suggest an alternative file type to use instead of gif, giving **two** advantages that it has over the gif format. 3

Section III

PART C—Multimedia Technology (continued)

29. A student is working on a presentation to publicise a band in which he is the lead singer. He wants to include video footage and some music samples. One of the band members suggests that they record their sessions in MIDI format and that the file size is the same as MP3.

- (a) State **one** advantage of storing sound as MIDI rather than MP3. 1
- (b) One attribute of MIDI is *tempo*. Name **two** other attributes of a MIDI file. 2
- (c) A sound engineer advises the band to record their music using MIDI, the vocals using PCM and then mix the soundtracks.
 - (i) Explain why the engineer gave this advice. 2
 - (ii) Before mixing the tracks the engineer further encodes the PCM vocals to produce the sound in a different file format. 2
 State the name of this format and explain why he took this action.
- (d) One of the sound samples lasts for 30 seconds. The output is shown below.



File settings: Mono, 11025 Hz, 16-bit PCM

- (i) Calculate the raw file size of the recording. 3
- (ii) Name an editing effect that has been applied to this sample and justify your answer. 2
- (iii) Explain what has happened at the part of the sample that has a circle around it and describe how to correct this problem. 2

Section III

PART C—Multimedia Technology (continued)

30. Justin runs a small hotel and is keen to have a website where clients can view his accommodation and make bookings online. He also wants to have a video tour showing the facilities available.
- (a) The website is designed using a WYSIWYG editor.
- (i) State a feature of a WYSIWYG editor that will allow all of the pages in the website to look similar. 1
 - (ii) State **two** advantages that a WYSIWYG editor has over a basic text editor. 2
- (b) During the design stage of the website, page layouts are inserted and the pages layout is planned. State **two** other features which will be included at this stage. 2
- (c) The video tour is created showing a tour of the bedrooms starting with a single room and finishing with the Executive Suite.
- (i) Justin would like the Executive Suite to appear first. Explain how this can be achieved. 2
 - (ii) Justin wants a sound track to play in the background 10 seconds into the video. Which feature of the editing software will allow this to be done? 1
- (d) The video is saved as an AVI file and a link is placed on the website allow clients to download the file.
- One of Justin's friends downloads the video and discovers that it takes some time to download the file.
- (i) Suggest **two** alterations to the original video settings that could be made to reduce the file size. 2
 - (ii) State **one** feature advantage that MPEG has over AVI which would help with the above problem **and** describe how it works. 3

[Turn over

Section III

PART C—Multimedia Technology (continued)

31. The image below is to be used for the cover of a new quiz game. The image supports 24-bit colour.



- (a) The image uses a CLUT.
- (i) What is the full name of the above term? 1
- (ii) Explain the purpose of a CLUT. 1
- (b) Name and describe a compression technique which would allow the image to be compressed without losing any image quality when it is decompressed. 2
- (c) Describe **one operation** which could be performed on an image to determine if it is a bit-mapped or vector graphic and explain your answer. 2
- (d) In most cases a bit-mapped image will have greater storage requirements than the equivalent vector image. Describe an image where this would **not** be the case. 1
- (e) Name **and** describe **one** file type suitable for 3D object oriented data storage. 2
- (50)**

[END OF SECTION III—PART C]

[END OF QUESTION PAPER]