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INFORMATION TECHNOLOGY

Paper 9626/12
Theory

Key messages

Responses showed a reasonable level of understanding of the syllabus, although some displayed a lack of detailed knowledge in particular areas of the syllabus.

For many questions, brief answers are not sufficient and expansion of points is required. These expansions need to add new information or analysis to answers, rather than repeating previously made points. Where questions ask for an evaluation, responses should judge the overall effectiveness of the given subject. It is not sufficient to just give features or uses. Questions requiring straightforward answers were well answered, but responses to more demanding questions often needed to contain more explanation or evaluation.

While mark schemes are a useful teaching and learning resource, reproducing marking points from previous mark schemes will rarely gain significant credit as responses must answer the question posed in the current paper. This was particularly relevant to **Question 5**, where responses were seen that described how a compiler works or described the differences between a compiler and an interpreter but did not give the advantages and disadvantages of using a compiler or evaluate its use in the context given. Similarly, responses to **Question 8** described what an MIS does but did not focus on its reporting function as required by the question.

General comments

Responding to evaluation, analysis and discussion questions in bullet point form does not allow for the detail or argument required at this level. Responses were seen that included tables divided into columns with 'Advantages' and 'Disadvantages' headings. While these may help candidates to structure their thinking, they do not provide a proper reasoned discussion or evaluation, which must be provided in prose form.

Some responses appeared to lack planning. For the more detailed questions, a good technique is to list thoughts in rough before choosing, and elaborating on, items that are relevant to the question.

Brand names should not be used in responses to questions. Instead, the software type should be referred to, for example, word processing software or database software.

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Comments on specific questions

Question 1

Many good responses to this question were seen, but some responses demonstrated a lack of understanding of the concept of a central processing unit. Stronger answers were seen for **parts (a)** and **(b)** than for **part (c)**.

(a) The vast majority of responses identified the correct option.

(b) Although a large majority of responses identified the correct answer, fewer correct responses were seen than for **part (a)**. The most common incorrect answer given was the fourth option: 'Per unit of memory, RAM is far cheaper to buy than a hard disk drive.'

(c) (i) Many responses displayed confusion about the central processing unit, often simply listing or described all of the internal hardware components of a PC. While some responses correctly identified the Arithmetic and Logic unit and the Control Unit as parts of the CPU, some of these did not mention the memory unit. Stronger responses went on to describe the functions of these units.

(ii) Descriptions of the motherboard were generally good, with most responses explaining that hardware components are connected to it and that it allows communication between the units. Sound cards were less well described. Many responses demonstrated only a vague understanding of their function, such as mentioning sound being input or output.

Question 2

(a) The majority of responses identified the correct option. A tiny minority incorrectly chose option 1 or option 3.

(b) This part was less well-answered than **part (a)**. Although many responses identified the correct option, options 2 and 4 were often incorrectly selected.

(c) Few strong responses to this part were seen. Many responses listed points, often just giving the differences between, or descriptions of, the two interfaces. While many responses explained that CLI was harder to learn to use as many commands need to be remembered, few other mark scheme points were seen except on the strongest responses.

Question 3

(a) This part of the question was well answered, with most responses giving two good examples of sources of static data.

(b) Most responses correctly explained that static data remains unchanged, and some also noted that it may rapidly go out of date. Few responses mentioned that data cannot be added.

Question 4

This question, in particular **part (a)(ii)**, proved challenging.

(a) (i) Some responses correctly identify the date of birth field as the one where the mistake in transcribing could not be identified by validation and were also able to explain why. Many misunderstood the question and attempted to compare validation to verification in general terms, while others were unable to identify the relevant error.

(ii) Although several responses included an appropriate method of verification, most did not go on to describe it. A few responses incorrectly mentioned proof reading.

(b) Many responses paired the correct fields with the correct validation check, but not all went on to describe the check in the detail required at this level.

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Question 5

Few responses gained full credit for this question. Many responses demonstrated an understanding of how a compiler works or gave descriptions of a compiler. However, the question required an evaluation of the use of a compiler for writing gaming software. Many responses referred to 'faster' and more/less memory without naming what the compiler was being contrasted with or expanding on any of their points. Strong answers referred to the given scenario.

Question 6

Very few detailed explanations of the digital divide were seen. Some responses included superficial comparisons between rich and poor, rural and urban etc, but these lacked detail. Many responses did not explain what was meant by 'modern technology'.

Question 7

This question was well answered, with many responses gaining at least partial credit. This was usually achieved by describing what the internet is or what the World Wide Web is. However, some responses demonstrated only a superficial understanding of the relationship between the internet and the World Wide Web. Few responses explained that the World Wide Web is just one of the services available on the internet, and many answers confused the two and incorrectly assigned characteristics of one to the other.

Question 8

Many responses gained at least partial credit for this question, However, some responses made very little reference to business. References were made to trends, decisions and graphs but without expansion or examples. Many responses described the general use of a management information system instead of concentrating on reports, their content and their uses.

Question 9

In general, responses to this question demonstrated very little understanding of a cell network, often confusing it with network traffic and packet switching. Many answers contained key technical terms but showed little understanding of them. Satellites and WANs were often incorrectly introduced to the answers.

Question 10

Many responses to this question indicated understanding of the workings of a computer-controlled car park barrier system and provided detailed descriptions of this type of system. However, they did not address the question which required them to analyse the use of real-time processing in this context. There were many descriptions of different kinds of car parking systems but very few addressed the issue of real-time processing. When real-time was mentioned, it was not in relation to the car park system being described. The question was an analysis question and there was little, or no, analysis seen. Very few mentioned the consequences of not having real time systems or the advantages of using this kind of processing.

Question 11

This question was generally well answered, with many responses demonstrating some understanding of the formula. A significant number of responses, however, gave a general description of what a query is and how to perform one. Responses sometimes deviated from the context of the date of an examination, referring instead to searching for books in a library.

Question 12

(a) (i) Most responses included an example of a cell but only a few went on to describe a cell.

(ii) This question was generally well answered, though a few responses confused horizontal with vertical.

(iii) This question was generally well answered, though a few responses confused vertical with horizontal.

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(iv) Nearly all responses included an example of a worksheet from the example workbook given but few went on to describe a worksheet accurately.

(b) Few strong responses to this question were seen. Many features of spreadsheets were mentioned but few linked these features to household accounts. Graphs and charts and conditional formatting were often named but no reason was given for why or how they should be used. The adjectives easy, quick and automatic were often seen, but these terms were not explained further. To gain full credit, responses needed to explain why a spreadsheet might be used for modelling household accounts, not just describe what a spreadsheet consists of.

Question 13

This question proved very challenging for candidates. While some responses described serial or sequential access, there were very few mentions of indexes. When indexes were mentioned, their meaning and use were not well explained.

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INFORMATION TECHNOLOGY

Paper 9626/02
Practical

Key messages

- The application of theoretical knowledge to practical problems (such as understanding the target audience or solving spreadsheet problems) is a vital skill for this component.
- Spreadsheet solutions should be designed with future growth in mind rather than only for the data that is currently present.
- Adding a second data series to a chart, using secondary axes in charts, and adding appropriate labelling to charts were areas that many candidates found challenging.
- Many solutions could have been improved with better understanding of good practice in the design and construction of a report for a specified target audience.

General comments

Many excellent solutions to the audio editing tasks were seen, but the spreadsheet and charting tasks proved more challenging. Candidates are advised to practise applying their knowledge to solve given problems.

Comments on specific tasks

Task 1

Almost all solutions included a spreadsheet resembling the one shown in the question paper. Most merged the cells in rows 1, 3 and 5 as shown and the majority set a pale blue background with dark blue lettering set to 48 and 20 points high respectively. Not all solutions centre aligned the cells in the range B7 to M13, nor left aligned the contents of column A and rows 5 and 6, and some solutions did not set the heights of rows 2 and 4 to match those shown in the question paper. Data entry of the text in the spreadsheet was not always accurate. The automated filename on the left in the header was often inserted accurately, but the data entry for the right side of the header was sometimes inaccurate. Almost all files were saved with the file name specified.

Task 2

This task proved more challenging than **Task 1**. Most solutions used the correct LEN function in cell B6. For the rest of the formulae, many attempts were made to trap out possible errors that may occur using functions such as ISERROR, IFERROR, ISERR, etc. These were frequently successful for most of the data but did not work as anticipated for the data in row 12. Solutions needed to show evidence of an attempt to trap out potential errors. In row 8, an efficient solution was to place replicable formulae using the MID function for all columns, rather than using the LEFT function in column B and MID function for the subsequent columns. The CODE function was frequently used correctly in row 9. Many solutions used DEC2BIN with the final parameter set to 8 so that this forced an 8-digit binary number. Where they did not do this, few candidates attempted to prevent a number with fewer than 8 digits, although there were several successful solutions seen, including that shown in the mark scheme and solutions using TEXT functions. Many solutions successfully rearranged the digits in row 11, although some incorrect submissions attempted to use the TRANSPOSE function. The formulae in rows 12 and 13 were frequently correct. Most solutions had an appropriate formula in cell B14 using either the CONCATENATE function or the & operator. However, a few did not include column M in this compression.

Task 3

Many solutions attained the correct encrypted string.

Task 4

The modelling required for this task proved more challenging than for **Task 3**. Many solutions did not successfully incorporate the instruction to 'Edit your spreadsheet to allow a stored text string with more characters' which required the spreadsheet to be extended and existing formulae to be replicated to the right for the new columns. The formula in B14 then had to be amended to include the results for the extra columns. There were also some data entry errors seen in the string entered into cell B5.

Task 5

This step required 'reverse engineering' of the functions used in **Task 2** in order to decrypt the encrypted data. However, it was not often completed successfully. Some submissions included a copy of the formulae used in **Task 2** which was submitted without changes. While few fully correct solutions were seen, a small number did make significant progress with the task.

Task 6

Many solutions gained some credit on this task, though fully completing the task proved challenging. The statement 'More data will be added to this each month' was an indicator that calculations should not be placed in the cells directly below the existing data as the patient data was not a finite list. This should have also been factored in when creating formulae, which should have allowed for future expansion. The requirement for a single replicable formula required careful thought with regards to absolute and relative cell referencing within the AVERAGEIF formulae. Some correct solutions were seen. However, a significant number did not use a single replicable formula that gave the correct result in subsequent rows and/or columns. Although the instructions were to round to the nearest whole day (using the ROUND function) there were a significant number of solutions that used other functions such as INT, ROUNDUP and ROUNDOWN.

Task 7

Many correct pie charts with two segments were seen, with the correct calculations used for the upper and lower parts of the body. Some charts did not include appropriate labels. These are required for the chart to be meaningful. Some solutions did not display the percentage values on the segments.

Task 8

Solutions to this task were varied. The requirement for 'an appropriate chart' indicated that one chart was required. Several solutions included two bar charts to display the data rather than a single comparative chart. Many solutions successfully created a single chart with the two data series visible, but including appropriate labelling was challenging. The two data series had very different types of data with different scaling requirements. Most solutions correctly set the axis maximum value to 10 000 for the first data series. However, few solutions included a second axis or appropriate labelling. Some solutions calculated the total instead of the average number of days for the second data series.

Task 9

Creation of the pdf file was generally well completed. However, many solutions would have been improved by adding appropriate titles and considering the layout. Some word-processed documents were created, while other solutions left the charts in the spreadsheet. In solving this task, it was important that the target audience (the directors of Tawara Health Service) were considered, and that a document with a professional appearance was produced.

Task 10

Almost all solutions saved the specified file in mp3 format with the required quality, although there were some instances of the audio being saved in mp4 format as a video. Fewer solutions changed the speed of the clip $\times 2$, with some slowing it down rather than speeding it up. Trimming the clip so the very noisy first 4.5

seconds was removed was often successfully completed, although occasionally the last 4.5 seconds were trimmed, leaving just the noisy introduction. Many solutions added reverb to the clip.

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INFORMATION TECHNOLOGY

Paper 9626/32
Advanced Theory

Key messages

Some good responses which demonstrated strong subject knowledge were seen. However, responses often lacked sufficient detail to gain credit. At A Level, responses are expected to provide more detail than single word lists or very short statements. These do not 'describe' or 'explain' as required by the questions. This is especially so in questions where 'discuss' or 'evaluate' is the command word in the question.

Some responses did not apply knowledge to the scenarios given in the questions and many answers were vague. A number of responses appeared to have resulted from candidates spotting key words in the question and writing answers based on those keywords. These responses were often generic and therefore gained little credit. While some marks may be awarded for generic answers, it is vital that candidates read the information given in the introductory stem at the beginning of a question very carefully so that they can apply their knowledge when answering the subsequent question.

Responses that repeat the statements made in the questions will not gain credit.

General comments

The syllabus gives a list of 'command words' and explains what each word requires. Responses to questions that ask candidates to 'explain', 'describe', 'evaluate', 'analyse' or 'discuss' a topic should be written in continuous prose and should expand on and discuss the points made. Some responses were written as bullet-pointed lists. These do not often gain credit because they rarely include descriptions, explanations or comparisons. Responses written in full sentences, using paragraphs, produce responses that gain more credit.

It is very important to note that the meanings of the command words have changed in the syllabus for March 2022 onwards so attention is drawn to the glossary on p.45 in the 2022–24 syllabus.

Responses to questions about new and emerging technologies should be restricted to what is possible and not to stray into the realms of science fiction.

Few candidates omitted questions. Candidates should always be encouraged to attempt all of the questions. Most candidates who used the spare pages or additional pages cross-referenced their answers. This makes it easier to ensure all relevant work for a question is seen and marked. Where additional space is required for answers, candidates should use additional pages as described above, and not write in margins, the blank space between or after questions, or alongside other questions.

Answers that candidates do not want to be marked should be clearly crossed though and a note added to indicate where the intended answer is written. 'Rough' notes, 'aide-de-memories' or planning notes should also be crossed through if they are not part of the actual answer.

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Comments on specific questions

Question 1

(a) This question required candidates to describe the transfer across the internet of a video stream from a server to a laptop. Most candidates correctly made references to using packet switching or to IP packets but few mentioned details of the role of the routers in the transfer. Good answers could have referred to the IP address being in the packets and to the use of dynamic routing and the updating of routing tables to ensure a good quality of service for the end user. Some responses described the transfer of packets from the laptop to the server, which was not required by the question although credit was given for the mention of the laptop initiating the stream by making a request to the server.

(b) Routers can be configured to prioritise video streams over other IP traffic. Good answers should have referred to a quality of service (QoS) configuration to prioritise the video stream or configuring the use of specific ports for the video service. Suggestions about the use of another router or adding a switch did not answer the question, which asked about the configuration of router E.

(c) This question was about the secure protocol used for the exchange of data between a web browser and a web server. HTTPS works at the application layer and uses TLS for the encryption and decryption process. It also provides for the authentication of websites using a certificate with public key and private keys. Responses referred to the protection from 'hacking' theft of data, but good answers should have referred to the use of TLS to secure the data exchange using encryption and providing protection against, e.g. 'man-in-the-middle' or eavesdropping attacks on the data. At A Level, credit is only gained by detailed answers.

Question 2

(a) Most responses clearly described the differences, which are that virtual reality is a computer-generated 3D environment that does not include the real world whereas augmented reality overlays digital elements onto a live view of the real world. A common error was to transpose the descriptions or to describe one or the other but not give the differences.

(b) This question elicited many generic answers or references to scenarios other than fire-fighting.. Responses must answer the question in the context set. Strong answers referred to the safety aspects, ability to repeat dangerous scenarios and the saving of resources and cost in the context of training firefighters. However, descriptions are required in order to gain credit and single words or statements such as '*safer*' or '*it's cheaper*' will not suffice at A Level.

Question 3

(a) A common error was to repeat the information in the question by describing the use of links to websites. Strong answers could have referred to the creation of time-based one-time passwords, specifying details such as passphrases for WiFi network login or the use in augmented reality to determine the position of objects.

(b) The key word 'Evaluate' in this syllabus requires candidates to '*discuss the importance of, weigh up the advantages and disadvantages, judge the effectiveness, weigh up your opinions'*. Advantages and disadvantages are required but, in addition, candidates should expand on these to explain why these are important or what effect they have. In this question, good answers could have included references to, e.g. QR codes can encode almost all types of data, e.g. numeric and binary so provide far more flexibility and choice for companies as to what they can include, QR codes have better fault tolerance than other code systems such as 1D barcodes so even if some part of the code is damaged information can still be decoded, QR codes take up less space on the packaging than a large amount of written information on the packaging so there is more room on packet for other image or /advertisements but, e.g. the smart phones that are used to scan QR codes are expensive compared with simpler phones so not all users have access and some users are not familiar with its use so may ignore the codes, an internet or mobile data connection is required to allow access to the additional information so the information may not be available if there is no connection.

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Question 4

This question asked candidates to describe the differences between chat rooms and instant messaging when used for social networking. Answers to this question were often very vague and lacking in the detail required to gain credit. Further, 'differences' were required so statements that described a chat room or instant messaging without comparisons were not given credit. Good answers described the differences clearly and succinctly, e.g. a chat room is a digital forum for communication using a web browser whereas instant messaging uses a dedicated application for communication.

Question 5

(a) Responses to this question were varied. The waterfall method of development is divided into phases starting with the creation of the requirements and analysis and ending with the deployment of the product. Each phase has tasks with a purpose and each phase follows from the previous phase. Responses needed to describe what happens at each phase and were able to gain credit without necessarily using the precise name for each phase. Weaker answers omitted accurate descriptions and some described methods other than the waterfall method. A common error was to describe rapid application development.

(b) Some responses accurately described the differences between alpha and beta testing but common errors were to describe one or the other but not give the differences or to give separate descriptions of each with the differences implied. Some responses transposed the descriptions. Good answers should have clearly stated the differences, e.g. alpha testing is carried out by employees of the developer whereas beta testing is carried out by end users who are not employees.

(c) (i) There are two aspects to teleworking that should have been in good answers. One is the working from a location away from the usual office, e.g. at home and the other is the use of telecommunications or IT resources to work.

(ii) Credit was given for either, or both, positive and/or negative effects. Good answers could have referred to, e.g. developers who telework may show reduced productivity or performance due to a lack of supervision or self-motivation and may become less associated with other employees or with the software company or, e.g. may have additional expense on resources such as IT equipment.

Question 6

Some responses referred to 3D printing rather than to holographic imaging.

(a) Credit was given only for responses based in fact. Answers to this type of question should not be speculative as candidates are only required to know how new and emerging technology is being used today. Good answers could have referred to the creation of heads-up displays showing flight instrument data or to showing targeting data for docking purposes with, e.g. the International Space Station.

(b) Holographic imaging is used in car manufacturing for creating extremely accurate images of items during production and for real-time/instantaneous quality control. Answers that referred to design process were given credit only if they related to car design.

(c) Holographic imaging is used by hospital doctors for, e.g. creating 3D images of body organs to practice surgery before the actual surgery or to have their patient's details displayed in their line of sight. It is not used to perform remote surgery by projecting a surgeon into an operating theatre on the other side of the world. As in **part (a)**, good answers should only refer to possible uses.

Question 7

In this question, good answers could have included references to, e.g. allowing more detailed answers to be collected so more data is gathered, follow up questions can be asked so incomplete answers can be clarified, but the analysis of the responses can be expensive as it may require manual data entry.

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Question 8

Candidates were required to discuss the use of public WiFi in the context of an airport. Most responses demonstrated an understanding of the advantages and disadvantages of using public WiFi connections. However, a significant number of responses consisted of bulleted lists and/or very brief statements. Good answers to 'discuss' questions must consist of descriptions or explanations that expand on the point being made, e.g. the user can use WiFi at little or no low cost as there may be no sign-up fee so can save on their use of their own mobile data allowance but public WiFi connections can be unreliable and inconsistent in connection quality with some internet services not available or restricted.

Question 9

(a) Responses to this question were good. Most accurately described three costs. Good answers could have referred to, e.g. the costs of human activities or the labour costs of carrying out activities, the costs of resources and equipment needed to carry out tasks or to the costs of legal requirements such as insurance, meeting regulations such as planning code compliance.

(b) This question was not well answered. Many responses described the features of project management software, but did not focus on estimating costs. Some described the types of PMS, which was not required. A good answer should have focussed on how costs can be estimated using PMS, e.g. calculating the cost of every activity in detail and using the results to calculate the total cost with, e.g. bottom up estimating, comparing the costs with those of similar, previous house building projects, using the formulae available in PERT estimation tools, and estimating the most likely cost with the project having no difficulties along with the worst possible cost estimate if the project tasks all went wrong.

Question 10

This question required candidates to describe how a GPS device is used to locate the position of an aircraft to which it is fitted. The context of an aircraft adds complexity as the altitude of the aircraft, even when it is on the ground, is also required. Many responses demonstrated confusion over how the GPS system works, with common inaccurate references to geostationary satellites, a two-way data exchange between receiver and satellites and the satellites being used to calculate the position and then send maps to the receiver. Good answers should have described the constellation of satellites continually sending timing signals which are received by GPS receivers, the requirement for four or more time signals to be received for the accurate calculation of a position in a three-dimensional space, a reference to, e.g. the use of trilateration in calculating the device's, and therefore the aircraft's, location and altitude and then the resulting location data being overlaid on a map for display as a visual representation or fed into the aircraft's instrumentation.

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INFORMATION TECHNOLOGY

Paper 9626/04
Advanced Practical

Key messages

Candidates need to pay close attention to examples or screenshots shown in the question paper and, if required, reproduce them very accurately. The colour, size, position and proportions of the components of any images, and the font attributes and alignment of any text, must be noted and carefully replicated.

General comments

Most candidates attempted all the tasks but solutions to the graphics and animation tasks would have been improved by a higher level of accuracy in reproducing the examples shown in the question paper. Database tasks involving calculated fields, validation and date functions proved challenging for candidates.

Comments on specific questions

Task 1

This task required candidates to recolour a map of the world. The most efficient method was to use adjustments to tolerances with select colour range tools. Employing simple fill tools was an option but then careful attention needed to be paid to the small areas that required greater precision. In particular, peninsulas and small islands were often incompletely filled or not properly outlined when using this method. Many solutions did not include distinct areas for the Great lakes and sea areas such as the Red Sea, the Persian Gulf and the Baltic Sea. Practice with these techniques and being aware of the importance of noting details within images would allow for improved solutions.

The second part of the task required candidates to distort part of the world map into a circle to represent a globe. They then had to add a band which would give the impression of a banner circling the globe.

Many good solutions to the first part of the task were seen, but some solutions did not closely reproduce the position of the land areas to match the example in the question paper.

The band and the text were usually completed successfully, but very few solutions included the view of the inside of the band at the edges of the globe. This part of the task needed some node editing of shapes to fit the space.

Task 2

This animation task required a circular mask to fill the stage and copies of the world map edited in **Task 1** to scroll from left to right behind it. Most solutions used a mask successfully and many correctly used more than one copy of the map to create a smooth animation. When animations are required to loop and run continuously, it is important that the looping point or restart is undetectable.

Task 3

This was a database task and required the creation of a reasonably simple data entry form. Care had to be taken to set appropriate data types, validation rules and calculated fields. Few solutions successfully used the date functions to satisfy the conditions detailed in the question paper. Another common issue was the use of 'less than' and 'greater than' comparators to achieve the correct results. It is good practice to test solutions to identify mistakes in configuring these comparators.

Task 4

Many successful solutions to the basic part of this mail merge task were seen. While many solutions demonstrated that the logic of the conditional fields was understood, some did not configure these fields with sufficient accuracy. By far the most common issue, however, was the selection of the correct recipients. In mail merge tasks such as these, close attention must be paid to the description of the intended recipients and appropriate methods must be used to select and exclude records from the data.

Task 5

This JavaScript task was well attempted, and few mistakes were seen with the syntax and the use of functions and variables. The most common issues were difficulty using date methods and the 'less than' and 'greater than' comparators. Very few successful attempts to use the required getDate() method were seen, but many partially correct solutions were seen.

In conclusion

Solutions could be improved by:

- determining and satisfying all requirements detailed or shown in the question paper
- use of colour range select tools
- precision in animation tasks so that 'restarts' in looping animations are undetectable
- expertise with database tasks that include the use of dates in calculated fields
- further opportunities for the development of mail merge skills, particularly in the logic of nesting conditional fields and the selection and exclusion of recipients or records
- greater expertise with Date Object Methods in JavaScript tasks.