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**INFORMATION TECHNOLOGY**

**9626/32**

Paper 3 Advanced Theory

**March 2017**

MARK SCHEME

Maximum Mark: 90

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**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Question	Answer	Marks
1	<p><b>Five</b> from:</p> <p>Because it is error-free, corrective maintenance is not needed</p> <p>Because there are no new situations likely to arise, adaptive maintenance is not needed</p> <p>Perfective maintenance is needed to modify the code ...enhance/add to the software capabilities to increase its usefulness</p> <p>Delete unused/obsolete functions to reduce the complexity/code size/resource requirements</p> <p>Optimise the code to increase functional speed</p>	5

Question	Answer	Marks
2	<p><b>Eight</b> from:</p> <p><i>Benefits:</i></p> <p>(Body worn) video cameras used to record incidents for later use in court/enquiry</p> <p>Optical (head-mounted) technology to display information is in a similar format to a smartphone/act as a smartphone so is familiar</p> <p>Operated hands-free via voice activation</p> <p>Wrist-worn computers/smartphones for access to communications systems</p> <p>Wi-Fi-enabled/wireless connected clothing to track movements in real-time/connect peripherals</p> <p>...monitor vital signs of officer</p> <p>...maintaining constant communications with others</p> <p><i>Drawbacks:</i></p> <p>Reliance on computers can remove elements of human judgment</p> <p>Implementation can be expensive since this is an emerging technology</p> <p>Can lead to invasions of privacy for user and third parties... ...location and other details can be used to track the user</p> <p>Possibility of wearable computers being 'hacked' and data stolen/computers manipulated</p> <p>Breakdown in communications systems can lead to system failure</p> <p><i>Max 6 for all benefits or all drawbacks</i> <i>1 mark available for a reasoned conclusion/opinion</i></p>	8

Question	Answer	Marks
3(a)	<p><b>Six from:</b></p> <p><i>1 mark for correct identification of critical path</i> <i>2 marks for each correctly calculated path</i></p> <p>Path 3 is the critical path            Path 1: start Task 1 Task 3 Task 4 finish = 3+7+2 = 12            Path 2: start Task 2 Task 5 finish = 5+4 = 9            Path 3: start Task 2 Task 5 Task 3 Task 4 = 5+4+7+2 = 18</p>	<b>6</b>
3(b)	<p><b>Four from:</b></p> <p>Each task on critical path has float of 0...            ..tasks 2, 3, 4, and 5            Next longest path is path 1 with tasks 1, 3 and 4....            ..3 and 4 are on critical path so their float is still 0            ..so task 1 has float of critical path duration (16) minus Duration of path 1 (12) giving float of 4</p>	<b>4</b>

Question	Answer		Marks
4	<p><b>Answers/Indicative content</b></p> <p><b>This question to be marked as a Level of Response.</b></p> <p>Answers may make reference to e.g.:</p> <p><b>Photo-realism:</b> bitmaps are comprised of small pixels so the bitmap is the most suitable format for photo-realistic images or images with high amounts of fine detail. The vector image, on the other hand, does not possess the same kinds of photo-realistic capabilities because it is comprised of larger objects and cannot achieve the kind of fine detail that is necessary for photo-realism.</p> <p><b>Scalability:</b> vector images are made of mathematically defined objects so sizes can be easily manipulated with little to no loss in the quality of the image. The objects within a vector image are re-rendered at a greater or smaller scale to provide consistently smooth edges. Bitmaps are more difficult to scale because changing the size of a bitmap requires a complete rearrangement of the pixels. An enlarged bitmap is likely to appear blurry, or “pixelated,” meaning that the different pixels of the image have become visible.</p> <p><b>Shape:</b> a bitmap image always has four straight edges while vector images can be any shape.</p>	<p><b>Level of Response</b></p> <p><b>Level 3 (7–8 marks)</b></p> <p>Candidates will evaluate in detail the suitability of both bitmap and vector graphics for use on the website. The information will be relevant, clear, organised and presented in a structured and coherent format. There will be a reasoned conclusion/opinion. Subject specific terminology will be used accurately and appropriately.</p> <p><b>Level 2 (4–6 marks)</b></p> <p>Candidates will explain the suitability of both bitmap and vector graphics for use on the website. For the most part, the information will be relevant and presented in a structured and coherent format. There may be a reasoned conclusion/opinion. Subject specific terminology will be used appropriately and for the most part correctly.</p> <p><b>Level 1 (1–3 marks)</b></p> <p>Candidates will describe the suitability of bitmap and/or vector graphics for use on the website. Answers may be in the form of a list. There will be little or no use of specialist terms.</p> <p><b>Zero marks:</b> Response with no valid content</p>	8

Question	Answer		Marks
	<p><b>Answers/Indicative content</b></p> <p><b>File size:</b> complex vector images can have a very large file size due to the complex instructions needed to create them; the size of the file is not dependant on the size of the image: small complex images can have a large file size; bitmap images can be large but can be compressed.</p> <p><b>Conversion between file types:</b> the most common file type for bitmap web images are jpeg or gif, and conversion to these is simple without loss of quality; conversion of vector images often results in more loss of quality.</p>	<p><b>Level of Response</b></p>	

Question	Answer	Marks
5(a)	<p><b>Eight from:</b></p> <p>(Civilian) signals from satellite travel by line of sight to navigation device/ receiver            Use L1/1575.42 MHz in UHF band            Satellites are Low Earth Orbit/LEO            Signal contains ID code of the satellite            ...and status/health information            ...and current date and time from atomic clock in the satellite            ...and almanac data about where each GPS satellite is at any point in time            Navigation device/ receiver must lock to (at least) 2 satellites to calculate 2D position (i.e. latitude and longitude)            To 4 or more (usually 4 to 7) satellites to calculate 3D position (i.e. latitude, longitude and altitude/elevation)            Using trilateration techniques            Calculation by finding intersect point by timing the signals from the satellites</p>	<b>8</b>
5(b)	<p><b>Five from:</b></p> <p>Atmospheric/ionosphere/ troposphere delays slowing the satellite signal slows as it passes through the atmosphere            Signal multipath errors as the GPS signal is reflected off objects before it reaches the receiver            ...increases the travel time of the signal            Clock errors in the receiver because the built-in clock is not as accurate as the atomic clocks on board the GPS satellites            Orbital errors ( ephemeris errors) of the satellite's reported location            The number of satellites visible may be too few because buildings/terrain/dense foliage may block the signal reception            electronic interference can block the signals            ...causing position errors /no position reading            ...GPS units usually will not work indoors, underwater or underground            Satellite geometry/shading because the relative position of the satellites at any given time is not ideal for signal reception by the receiver            ...the satellites should be located at wide angles relative to each other            ...poor geometry occurs when the satellites are located in a line/tight grouping            Intentional degradation of the satellite signal by the operator/owner of the satellites            ...to prevent military adversaries from using the highly accurate GPS signals</p>	<b>5</b>

Question	Answer	Marks
6	<p><b>Eight from:</b></p> <p>Reader communicates via secure wireless connection with restaurant base-station            Base station communicates with bank computers            Mobile reader reads the data from the card            Requests input of PIN from customer            PIN checked/validated against stored PIN            Request sent to restaurant's bank to determine the cardholder's bank/issuing bank            Request sent to card issuer/bank to authorise the transaction            ...authorisation code sent to restaurant's bank if credit is available            Credit card is validated/credit available            ...if valid/available then transaction can proceed            ...if not valid/available then transaction is refused            If transaction can proceed the amount of the transaction is deducted from the cardholder's account            Receipt is printed from the mobile reader</p>	8

Question	Answer	Marks
7(a)	<p><b>Three from:</b></p> <p>The computer-to-computer            Exchange of business documents            Using a standard electronic format            Between business partners</p>	3
7(b)	<p><b>Five from:</b></p> <p>Prepare the documents to be sent            Collect/organise the data via human interface screens/typing            Extract from databases/spreadsheets/output from stock control/purchasing systems into data files            Translate the documents into EDI format            Convert internal data into EDI standard format            Transmit the EDI documents to trading partner            Use VPN/secure private network            Via an EDI network provider that connects the trading partners together</p>	5

Question	Answer	Marks
8	<p><b>Eight from e.g.:</b></p> <p><i>Benefits of Packet Switching include e.g.:</i>            Makes very efficient use of the network as communication lines are shared            Data packets can be routed around unusable nodes/parts of the network so if part of network/node is faulty/not working packets can still reach destination            The network only has to expand slowly with increase in users compared to circuit switching</p> <p><i>Drawbacks of Packet Switching:</i>            The packaging of the data changes each time a packet is switched so there is a time overhead/latency            Can cause a problem for time-critical information such as an emergency signal/video streaming            Small data packages are inefficiently packaged (e.g. a data package of 600 bytes uses two packets of 512 bytes plus the address information)</p> <p><i>Max 6 for all benefits and drawbacks</i>  <i>1 mark available for a reasoned conclusion/opinion</i></p>	8

Question	Answer	Marks
9(a)	<p><b>Four from:</b></p> <p>Method 2 uses an array...            ....which stores multiple values in a single variable            More suitable for storing large numbers of items/data items as it reduces the complexity of the code            Increases the code easier to understand            Increases the execution speed of the code            Method 2 can be looped through using an iterative function            ...to find a specific data item</p>	4
9(b)	<p><b>Two from:</b></p> <p>Jonas wanted to explain/add comments to the code/what the line of code means/is for            To make it clear that the code referred to a list of the cities            Ensures that the explanation/comment was ignored by the web browser            To make the code more readable/understandable</p>	2
9(c)	<p>A suitable line of code would be: var place = city(2)</p> <p><b>Three from:</b></p> <p>var =1 mark            plus suitable variable name to store city e.g. place =1 mark            = city(2) =1 mark</p>	3

Question	Answer	Marks
9(d)	<p>Suitable code would be:</p> <pre>for (b = 0; b &lt;= 3; b++) {     document.write (city (b)); }</pre> <p><i>Marks, four from:</i></p> <p>for () 1 mark  suitable var names 1 mark  count from to 0 to 2 (b from 0 to &lt;=3) 1 mark  adding 1 inside loop (b++) 1 mark  displaying the result of loop 1 mark</p>	<b>4</b>

Question	Answer	Marks
10(i)	<p><b>Three from:</b></p> <p>Interview face-to-face with managers asking about their views/opinions of the current system  Managers can be available for in depth discussion/additional questions  Not many managers, so time is not a constraint/consideration</p>	<b>3</b>
10(ii)	<p><b>Three from:</b></p> <p>Observation of the assembly workers to avoid disturbing/distracting them at/from their work  Observers can see the process first hand/for themselves  Observers do not need to understand the technical language of the process</p>	<b>3</b>
10(iii)	<p><b>Three from:</b></p> <p>Using questionnaires so that clerical staff can take them away and complete in own time  Questionnaires can be anonymously returned/completed  Cannot use observation as the clerical staff behaviour could change  Too many clerical staff to interview  Clerical staff can remain anonymous</p>	<b>3</b>
	<b>Total:</b>	<b>90</b>