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.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.
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<thead>
<tr>
<th>Question</th>
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<tbody>
<tr>
<td>1(a)</td>
<td>Signal is switched on/off/in pulses to represent the code being sent.</td>
<td>1</td>
</tr>
<tr>
<td>1(b)</td>
<td><strong>Two from:</strong> Line of sight only so will not affect other devices in home/building Short distance so will not interfere with other devices Short distance so uses very little (electrical) power.</td>
<td>2</td>
</tr>
<tr>
<td>1(c)</td>
<td><strong>Two from:</strong> Games controller/ joystick to navigate/play using buttons/paddles Use of touchscreen with ‘app’ on smartphone to replicate navigation features Microphone for entering voice commands Keyboard/pad for entering alphanumeric characters/user names/id/password.</td>
<td>2</td>
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</table>
| 2(a)     | **Eight from e.g.:**  
Has WAN and LAN ports for connection of (W)LAN to internet  
USB ports to allow sharing of (multimedia) files  
Has multiple NICs, for connection to different networks/internet  
...support 10/100/1000 Mbit/s networks  
Act as gateway between networks  
...provides ADSL/cable connection to WAN  
...provides routing tables/‘default’ gateway  
Combines function of router and WAP  
Has wireless NIC  
....to allow/provide use of Wi-Fi  
....to provide use of 2.4/5Ghz wireless bands  
Provides security facilities for network  
....Wi-Fi security facilities  
...one touch connection for wireless peripherals e.g. Printer  
Provides DHCP functions  
....to allow automatic provision of addressing for connected devices  
Has web-based administration interface  
....allows user to configure the router  
Uses open-source/Linux operating system for ease of  
update/customisation  
Wi-Fi clone facility to add WAPs  
Provides USB interface for use of flash memory devices/external storage devices as NAS. | 8 |
| 2(b)     | **Six from:**  
Traffic sent as IP packets from device  
...packet contains destination in header  
Device looks up destination IP in its DNS table  
....if IP address not known sends packet to ‘default’ gateway/router address  
....if known sends packet to IP address  
Router examines packet header  
....to determine destination IP address  
...looks up IP address from DNS server  
....if IP address not known sends packet to another router  
....if IP address known sends packet to IP address of server. | 6 |
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| 3(a)     | **Four from e.g.:**  
Signal is spread over a number of frequencies within the band  
...frequency hopping is where carrier frequency is rapidly switched  
...using a code known to both transmitter and receiver  
Uses a pseudorandom number generator to produce the codes  
...direct spread where signal is spread over a range of frequencies  
...centred on the main/nominal frequency  
Can be a mixture of frequency hopping and direct spread. | 4 |
| 3(b)     | **Six from:**  
Increased resistance to interference  
Increased resistance from 'jamming'  
Increased bandwidth  
Increased resistance to eavesdropping/interception  
Increased resistance to multi-path reflections/fading  
Allows multiple users/access by multiple devices  
Can transmit on same frequency as others by using different code  
Limits power density so safer to use. | 6 |
| 3(c)     | **One from:**  
Bluetooth  
GPS. | 1 |
| 4        | **Six from:**  
Knowledge base has many individual items of information/facts that need updating so each item interacts with many other items during reasoning  
...difficult to check all/every interaction  
Knowledge base objects are inter-dependent so modifying/updating one will affect another  
...creating a need for more modifying  
Inferences/reasoning carried out during processing is not easily observed  
...system makes inferences as processing occurs and changes/adds facts  
...so changes may affect reasoning in unknown ways  
Changes may cause other changes to be made which may create need for more changes. | 6 |
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<tr>
<td>5</td>
<td><strong>Six from:</strong>&lt;br&gt;Examine patient to determine symptoms/collect data&lt;br&gt;Enter symptoms/data into expert system via user interface&lt;br&gt;Collect symptoms via sensors attached to patient&lt;br&gt;Doctor/patient enters answers to questions into user interface&lt;br&gt;Expert system searches knowledge base for match with symptoms/data&lt;br&gt;Inference engine uses rules base&lt;br&gt;...to add data to working memory&lt;br&gt;...to use rules/conditions to find match for symptoms/data&lt;br&gt;...to add data that could trigger use of more rules&lt;br&gt;...use of forward/backward chaining to match conditions/data&lt;br&gt;...to produce list of probable/possible/suggested diagnoses/illnesses&lt;br&gt;Results presented via user interface to doctor/patient as hardcopy/on screen&lt;br&gt;Doctor uses results and own knowledge to make diagnosis.</td>
<td>6</td>
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<td>6</td>
<td><strong>Eight from:</strong>&lt;br&gt;<strong>Advantages of e.g.:</strong>&lt;br&gt;Email has an audit trail for record keeping&lt;br&gt;Email can be answered/replied to at different times/at doctor’s convenience&lt;br&gt;Email can have files attached for others to consult&lt;br&gt;Chat rooms are in real time/discussions are in real time&lt;br&gt;Chat rooms mean doctors do not have to travel to talk to others&lt;br&gt;Instant messaging is in (almost) in real time/discussions are in (almost) real time&lt;br&gt;Instant messaging allows doctors to do other tasks&lt;br&gt;Video chat/conferencing can reduce costs of visits to other doctors/meetings&lt;br&gt;Video chat/conferencing can be used to replace meetings where doctors have to travel&lt;br&gt;&lt;br&gt;<strong>Disadvantages of e.g.:</strong>&lt;br&gt;Email is not secure&lt;br&gt;Emails may not be delivered&lt;br&gt;Emails can be ignored&lt;br&gt;Chat rooms can hide/do not necessarily show doctors identity&lt;br&gt;Instant messaging does not allow time to consider the message before it is sent&lt;br&gt;Instant messaging can easily be misused&lt;br&gt;Video chat/conferencing reduces personal interaction&lt;br&gt;Video chat/conferencing can be affected by technical issues/different time zones.</td>
<td>8</td>
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*Max 6 marks for all advantages or all disadvantages. One mark available for a reasoned conclusion.*
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<tr>
<td><strong>7</strong></td>
<td><strong>Six from:</strong></td>
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</tr>
<tr>
<td></td>
<td>Attach sensors/named sensors to patient</td>
<td></td>
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<tr>
<td></td>
<td>...connect sensors to computer system</td>
<td></td>
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<tr>
<td></td>
<td>...via ADC/convert analogue signals to digital</td>
<td></td>
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<tr>
<td></td>
<td>Computer continually reads/stores data from sensors</td>
<td></td>
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<tr>
<td></td>
<td>...processes data for display</td>
<td></td>
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<tr>
<td></td>
<td>...compares data to pre-set values</td>
<td></td>
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<tr>
<td></td>
<td>Data output/displayed on screen for doctors/nurses to watch</td>
<td></td>
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<tr>
<td></td>
<td>...accompanying sounds to reassure monitoring staff that all is well</td>
<td></td>
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<tr>
<td></td>
<td>...hardcopy produced</td>
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<tr>
<td></td>
<td>...stored data used for analysis/comparison over time</td>
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<tr>
<td></td>
<td>...alerts/alarms sounded if pre-set parameters exceeded.</td>
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<td><strong>8</strong></td>
<td><strong>Six from:</strong></td>
<td>6</td>
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<tr>
<td></td>
<td>Web browser uses HTTPS</td>
<td></td>
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<tr>
<td></td>
<td>Website operator/owner acquires/has a certificate from a certificate provider</td>
<td></td>
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<td></td>
<td>...using a certificate signing request</td>
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<td></td>
<td>Digital identity certificate provides a public key</td>
<td></td>
</tr>
<tr>
<td></td>
<td>...holds website owner name/information</td>
<td></td>
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<tr>
<td></td>
<td>...website owner email address</td>
<td></td>
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<tr>
<td></td>
<td>Certificate provider has checked that the website owner has authority to use website address/domain</td>
<td></td>
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<tr>
<td></td>
<td>Certificate provider signs certificate and provides a public document</td>
<td></td>
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<tr>
<td></td>
<td>Web browser is sent digital certificate when it accesses website</td>
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<tr>
<td></td>
<td>Web browser reads certificate information</td>
<td></td>
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<td></td>
<td>...uses public key to decrypt certificate</td>
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<td></td>
<td>...checks against built-in list of trusted/root certificates</td>
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<td></td>
<td>...if certificate is valid then website is authenticated</td>
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<td></td>
<td>...if certificate is not valid user is given popup warning that site has not been authenticated.</td>
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| 9(a)     | *Four from:*  
At least 8 characters long  
Contains characters mixture of uppercase/lowercase/numbers  
...keyboard characters/symbols not defined as numbers or letters  
Does not contain a complete word or phrase  
Is different from previous passwords  
Does not relate to the user/contain the user name  
Does not repeat characters too often. | 4 |
| 9(b)     | *Four from:*  
Users may write down passwords in accessible places if...  
...passwords are excessively complex  
...required to be changed too frequently  
Users may have too many passwords to manage  
...so may use same password for all accounts  
Users may choose weak passwords if not allowed to write down password  
Special characters may prove difficult to use if travelling in different countries/keyboards  
Identity management systems may require one password to access all others  
....the master password may be easily found by hackers/social engineering techniques. | 4 |
| 10       | *Four from:*  
Basic requirements are identified  
...input and outputs determined  
Initial/first prototype developed  
...only includes user interfaces  
Customers/end-users examine the prototype  
...provide feedback on additions or changes  
Prototype is revised/enhanced  
...based on user feedback  
Prototype build and end user examination may be repeated. | 4 |
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| **11** | *Six from:*
| | *Benefits include e.g.*
| | Reduced costs of development
| | Reduced time of development
| | ...as any changes are made during development
| | Increased user involvement
| | ...fewer misunderstandings/interpretations of design
| | ...final product more likely to satisfy the end-user
| | Can experiment with prototype before building final product
| | *Drawbacks include e.g.*
| | Analysis of requirements can be inadequate
| | ...complete project may not be analysed
| | ...better solutions may be overlooked
| | Confusion of end user over what is actually wanted/required
| | ...developer and end user may have different ideas of what end product should be
| | Excessive time spent on developing prototype
| | ...prototype may become too complex
| | ...not meet end user requirements
| | *Max 5 marks for all benefits or all drawbacks.*
| | *One mark available for a reasoned conclusion.*

**Total:** 80