Mark Scheme (Provisional)

Summer 2021

Pearson Edexcel International Advanced Subsidiary
In Information Technology (WIT13/01)
Unit 3

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Additional guidance	Mark
1 (a) (i)	Award **one** mark each for any of the following up to a maximum of **two** marks. • location (1) • status, hired/free (1) • traffic conditions/average speed over last time period/minute (1) • taxi ID/registration number (1)		**2**
1 (a) (ii)	Award **one** mark for any of the following up to a maximum of **two** marks. • pick-up/booked time for a journey (1) • start point of a journey (1) • end point of a journey (1)		**2**

Question number	Answer	Additional guidance	Mark
1 (b)	Award **one** mark each for any of the following up to a maximum of **three** marks. • traffic conditions on the route (1) • traffic regulations/changes to regulations such as speed limits/one-way roads (1) • detours that would reduce overall time (to avoid traffic/hold-ups)(1) • known variations of traffic due to time of journey, e.g. rush hour (1) • road works (1) • events taking place (1) • tolls (1)	Award any item that is applicable locally due to special conditions. e.g. checkpoints	**3**

Question number	Answer	Additional guidance	Mark
1 (c) (i)	Award **one** mark each for any of the following up to a maximum of **two** marks. • audio/driver's voice may be masked by taxi/road noise (1) • system may not be able to hear/may not respond to commands (1) • system may be fooled by/misled by/respond to voices in the taxi e.g. passengers, on the radio (1) • system may give incorrect guidance/information (1) • system may mishear driver due to accent/speech impediment (1)		**2**
1 (c) (ii)	Award up to **three** marks for a linked explanation. Answers may include: • haptic means a touch related feedback/interface (1) • steering wheel/system could vibrate/be fitted with vibration/rumble pads (1) • vibration indicates direction of next turn by position on the wheel/coded pulse (1) • vibration rate/intensity changes with distance to next turn (1) Example: • The system could vibrate (1) to indicate which way to go (1) and make the vibrations harder as the turning gets closer. (1) • haptic means an interface that the driver can detect by touch (1) it could have the steering wheel rumble/vibrate (1) on the side that the next turn will be. (1)		**3**
		Total for question 1	**12**

Question number	Answer	Additional guidance	Mark
2 (a)	Award **one** mark each for any of the following up to a maximum of **three** marks. (A distributed database): • contains multiple centres/nodes/database copies (1) • reduces round trip time for a query (1) • makes the system more responsive (1) • is able to deal with more queries per second (1) • provides redundancy/reduces chance of a failure/improves reliability (1) • is easy to scale/easy to add new nodes (1)		**3**

Question number	Answer	Additional guidance	Mark
2 (b) (i)	Award **one** mark for: • Concurrency means that several people have simultaneous access to/can change the same data		**1**
2 (b) (ii)	Award up to **three** marks for a linked explanation. Answers may include: • database queries may involve changes to the data (1) • change on one/local version of database have to be propagated/sent to other versions (1) • different servers may have different versions of the data (1) • updating all the database versions involves a lot of data movement (1) • changes take time/resources/costs money (1) • queries on other versions of the database will give wrong answers until data is propagated (1) • large number of queries/updates means that system is never fully coherent/always lacks some integrity (1) • the database versions may be widely separated (1) Examples: • Queries often change data (1) if data changes on one node it may not get changed on another (1) and could give wrong answers there (1) • Database changes have to be sent to all the other databases (1) this takes a lot of resources (1) because there are millions of queries being done (1) • Database versions may be in different continents (1) there will be delays in updating them when one changes, (1) this may cause errors in query results (1) • Distributed databases have to update all the versions (1) this can cause loss of integrity (1) because of the time needed to make the updates (1)		**3**

Question number	Indicative content	Mark
2 (c)	Answers should be about how normalisation can reduce the problems of data redundancy in the context of a relational database. Data redundancy **may** occur when a piece of data/field value is stored more than once/in more than one location. Data redundancy **does** occur when the field value is stored more times than is necessary (for the correct operation of the database). Problems caused by data redundancy: • waste of storage space • increased operational cost • insert/update/delete anomalies • requirement to update every instance if something changes • if one instance is missed, there will be inconsistent data in the database, this makes the existing problem, of maintaining integrity worse • data integrity is likely to gradually degrade over time as more errors are propagated through the system Normalisation reduces redundancy: • breaks data into logical units/tables/entities • the database should be normalised to at least third normal • units do not contain repeated items/only have one instance of each field - reduces storage space • a unit/table/entity can have the same field(s) as another, but these are linked as keys, when one instance of a key is changed the others update automatically - solves the update problem and prevents inconsistency • links between tables solve the anomaly problems.	**6**

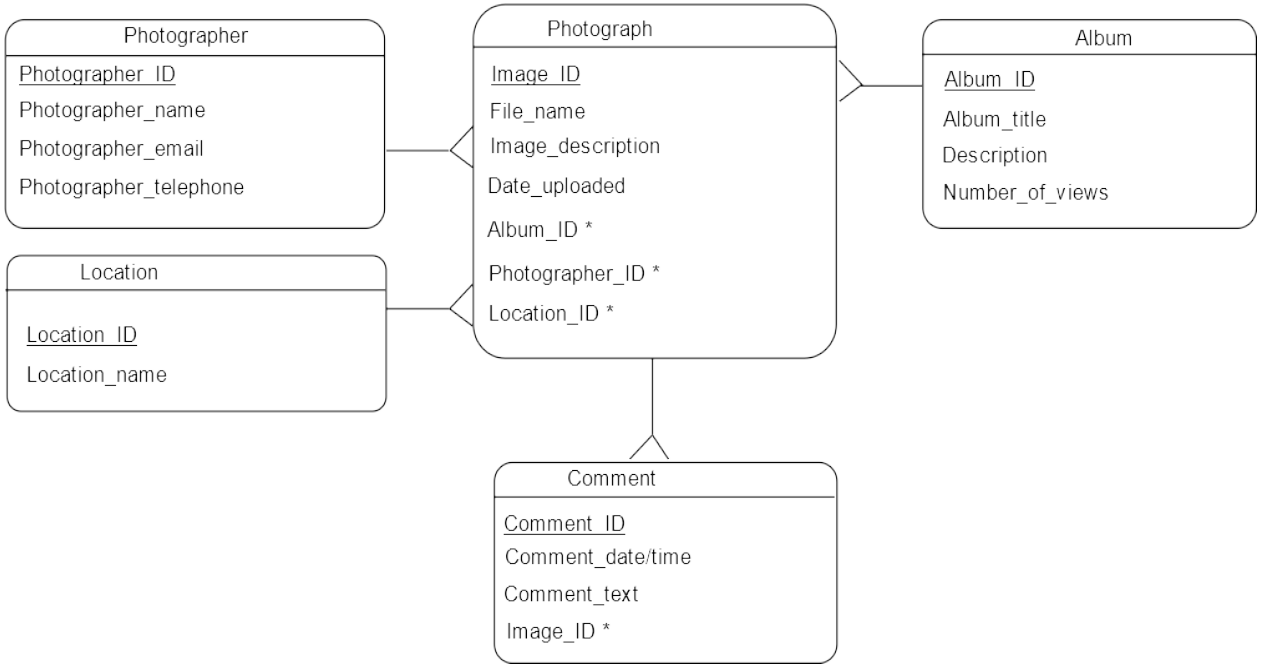
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates limited knowledge and understanding, some of which may be inaccurate. • Applies understanding with limited coherence to produce a superficial and unbalanced discussion.
Level 2	3–4	• Demonstrates knowledge and understanding which is mostly relevant but may include some inaccuracies. • Applies understanding to make some coherent connections, leading to a discussion that shows some development, but may be unbalanced.
Level 3	5–6	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a balanced and fully developed discussion.
		Total for question 2. 13

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>3a</td><td>Award one mark for each point to a maximum of six marks.

• Table name uses an appropriate convention (1)
• The primary key is shown (1)
• All data types are appropriate (1)
• All text field lengths are appropriate (1) (If image_ID is given as int, it does not need a length) (allow any reasonable, non-default field sizes)
• Date field formats are appropriate (1)
• Email field has a format/validation (1)

<table>
<tr><td>Table name</td><td colspan="2">Tbl_Photograph</td><td></td><td></td></tr>
<tr><td>Attribute / field name</td><td>Data type</td><td>Key (P/F)</td><td>Field size</td><td>Format/validation</td></tr>
<tr><td>Image_ID</td><td>int or text</td><td>P</td><td>6</td><td></td></tr>
<tr><td>File_name</td><td>text</td><td></td><td>50</td><td></td></tr>
<tr><td>Image_description</td><td>text</td><td></td><td>255</td><td></td></tr>
<tr><td>Date_uploaded</td><td>date</td><td></td><td></td><td>format e.g. dd/mm/yyyy ccyy-mm-dd</td></tr>
<tr><td>Photographer_name</td><td>text</td><td></td><td>50</td><td></td></tr>
<tr><td>Photographer_email</td><td>text</td><td></td><td>50</td><td>*@*.* / text@domain</td></tr>
<tr><td>Photographer_telephone</td><td>text</td><td></td><td>15</td><td></td></tr>
</table>
</td><td>Data types could also be e.g.:
VARCHAR if field content length is variable.
CHAR if length is fixed.
NUMERIC or NUMBER instead of int.
STRING instead of text.

Image_ID field size does not apply to integers.</td><td>6</td></tr>
</table>

3b	The diagram is an example of what the candidates might produce. Other layouts and content are acceptable if they conform with the marking points. Award **one** mark for each point to a maximum of **nine** marks. • is a logical data model diagram (minimum of two entities joined by a typed relationship and a primary key) • new entity created for Photographer (does not have to be called Photographer) • photographer contains attributes; Photographer_ID, name, email, telephone • ID attributes shown in Album, Location, Comment • ID attributes for each entity (photographer, album, location, photograph and comment) are shown as primary keys • Comment entity changed from 'Comments' • foreign keys shown in Photograph - Album_ID, Photographer_ID, Location_ID • foreign key shown in Comment - Image_ID • correct relationships - many to one - between Photograph and Photographer, Location, Album. • correct relationship - one to many - between Photograph and Comment • no extra or missing fields in any entity 	Any sensible and consistent names may be used for the entities and attributes.	**9**
		Total for question 3	**15**

Question number	Answer	Additional guidance	Mark
4 (a)	Award up to **two** marks for each of **two** linked explanations. Answers may include: • clearly defined roles and responsibilities (1) • clearly specified objectives (1) • detailed planning • effective leadership/direction/accountability (1) • monitoring and intervention (1) • managed expectations (1) • enforced quality control (1) Examples: Good project management involves the setting of clear objectives (1) which can be monitored to see that they are being met (1) A successful project is helped by detailed planning (1) that gives everyone clear roles and functions (1) A features of project management that contributes to a successful IT project is quality control (1) where people are held accountable for their contribution to the project (1)	For two marks a feature must be identified and expanded	**4**

Question number	Indicative content	Mark
4(b)	Indicative content. Phases: • requirements/analysis • design • implementation • testing/debugging • installation • maintenance Information sources/recipients/entities supplying/receiving information: • clients • designers/analysts • other stakeholders e.g. users/specified user roles • testers • contractors e.g. installers, engineers • vendors/suppliers Examples of information being moved in each phase: • requirements/analysis ◦ client requirements/specifications ◦ designer/analysts questions/suggestions ◦ information about budgets, schedules ◦ answers to questions/responses to suggestions, etc. ◦ input from stakeholders • Design ◦ specification/requirements document from requirements/analysis phase ◦ input from stakeholders ◦ information about hardware requirements/availability ◦ information about software requirements/availability	**12**

- Implementation
  - design documentation from design phase
  - coding requirements
  - completed code

- Testing/debugging
  - completed software from implementation phase
  - software test plan/testing instructions
  - software test results and comments

- Installation
  - hardware/network design documents from design phase
  - installation instructions
  - installation feedback/reports
  - hardware/network test plan/testing instructions
  - hardware/network test results and comments
  - feedback from clients/stakeholders

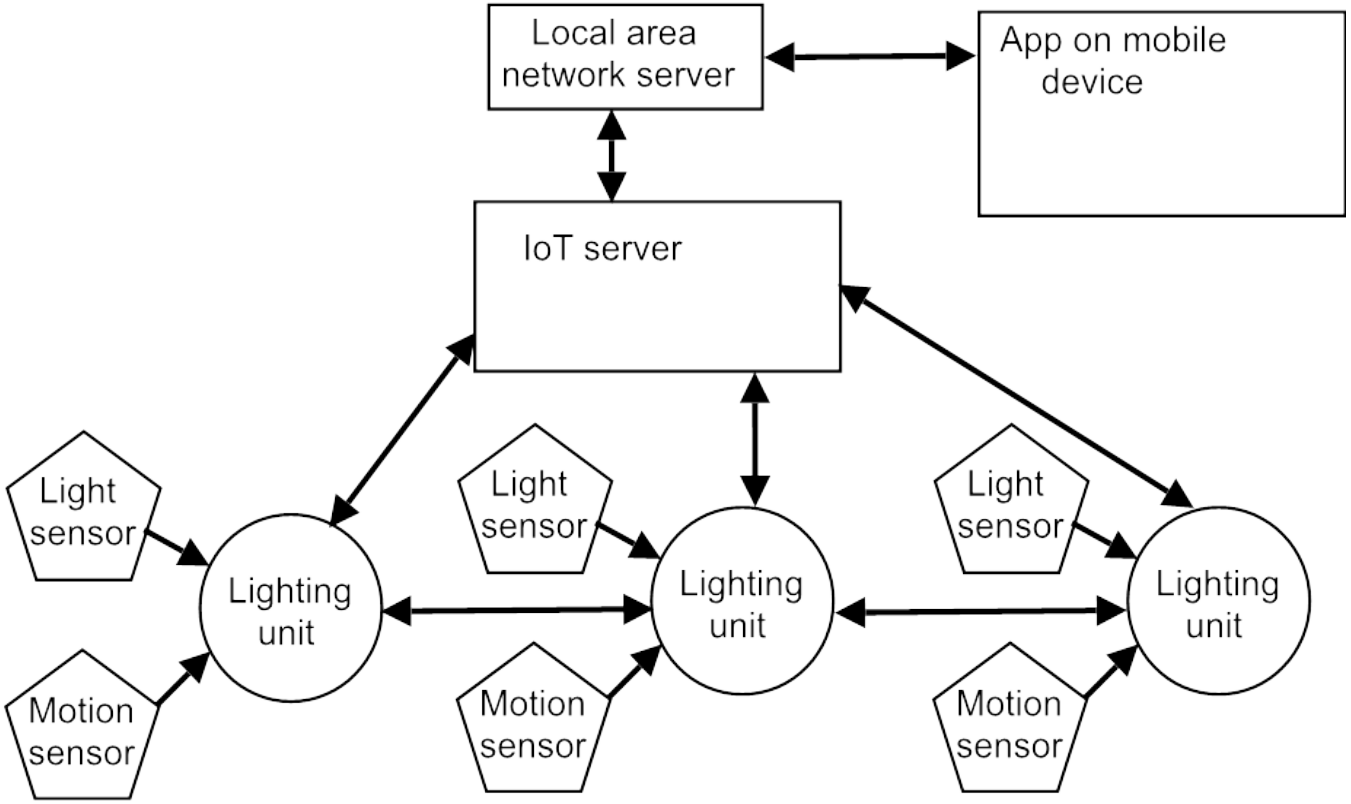
- Maintenance
  - final/amended design documents from previous phases
  - maintenance documents/manual
  - patches and updates
  - feedback from clients/stakeholders

Conclusion
Phase that has the most critical requirements.

This will probably be the requirements/analysis phase since it is essential to get this right before embarking on the rest of the project.

Candidates may argue other phases, such as testing.
Candidates should select one phase and support their choice with arguments from/reference to their evaluation of information movement.

Level	Mark	Descriptor	
	0	No rewardable material.	
Level 1	1–4	• Demonstrates limited knowledge and understanding, some of which may be inaccurate. • Applies understanding with limited coherence to produce a response that lacks development. • Demonstrates limited awareness of competing arguments. • Conclusion, if present, is generic or unsupported.	
Level 2	5–8	• Demonstrates knowledge and understanding, which is mostly relevant and may include some inaccuracies. • Applies understanding to make some coherent connections and a partially developed response. • Demonstrates some awareness of competing arguments, but this may be unbalanced, and partially supports conclusion with evidence.	
Level 3	9–12	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a fully developed response. • Demonstrates an awareness of competing arguments and supports conclusion with evidence.	
		Total for question 4	**16**

Question number	Answer	Additional guidance	Mark
5(a)	Award **one** mark for each point up to a maximum of **six** marks. • mobile device (app) connects to the LAN/server (1) • IoT server/ (IoT) router / (IoT) controller shown (1) • light sensor **and** motion sensor shown for at least **one** lighting unit (1) • light and motion sensors only connect to their own lighting unit (1) • three lighting units connected in a mesh with the IoT server (1) • all connecting lines on candidate's diagram have arrows showing the correct direction(s) (1) 	Allow any consistent use of shapes or labels. Must have IoT for Server, allow controller/ router without IoT	**6**

Question number	Indicative content		Mark
5 (b)	Answers should be about the role of system maintenance in a smart lighting system. Maintenance types • perfective • adaptive • corrective • (preventative) Perfective: • making modifications to the system in order to improve it • might involve ◦ better sensors ◦ giving more functions to the app/control software ◦ adding security features. Adaptive: • making modifications to meet changing goals/new requirements/changes to other, interacting systems • might involve: ◦ installing new lights/bulbs due to changes in building regulations ◦ changing communications methods such as WiFi channels to avoid interference ◦ altering security settings in response to a threat/new malware Corrective: • making modifications to fix bugs / errors • might involve ◦ errors made during installation ◦ manufacturer errors discovered in system hardware/software ◦ replacing items that are broken / worn out.		**6**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates limited knowledge and understanding, some of which may be inaccurate. • Applies understanding with limited coherence to produce a superficial and unbalanced discussion.
Level 2	3–4	• Demonstrates knowledge and understanding which is mostly relevant but may include some inaccuracies. • Applies understanding to make some coherent connections, leading to a discussion that shows some development, but may be unbalanced.
Level 3	5–6	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a balanced and fully developed discussion.
		Total for question 5. 12

Question number	Indicative content	Mark
6	Responses must be in the context of using machine learning to analyse wildlife from photographs. **Supervised learning (with a labelled dataset)** • Someone/a supervisor must judge whether the machine learning algorithm/system is getting the right answers. • The supervisor needs to produce a full set of labelled data/photos to use while training the algorithm. • In this case a labelled dataset of wildlife photos would tell the algorithm which photos were of which species/type of wildlife/animal. • When the algorithm looks at a new photo, it compares it to the training examples to predict the correct name/label/tag. • The training photos need to be comprehensive, wildlife that has no training photo will not be (correctly) identified. • Would only work in the given context if all wildlife species in the area are already known. **Unsupervised learning (with an unknown dataset)** • The algorithm/system is trained on an unlabelled set of photos. • The photos do not have to be comprehensive/include all expected wildlife. • The algorithm tries to make sense of the photos by extracting features/patterns. • Photos with features/patterns in common are identified as being the same species/given the same tag (clustering). • Sets/clusters of photos would need to be manually identified/labelled at some point. • Learning/identification/tagging would not be affected by an unexpected/unknown species being in a photo. • There is a danger that the algorithm may identify non-wildlife features, e.g. plants, as part of a species and could tag/identify a photo that only has the plant. **Conclusion** There is no preferred option. Both supervised and unsupervised learning have advantages in this context. The candidate should select one of the two options and support their choice with arguments from/references to their evaluation of the two types. A conclusion that states that more, specified, data/information is needed to make a choice or a conclusion that a combination of methods (semi-supervised) would be better would also be acceptable.	**12**

Level	Mark	Descriptor	
	0	No rewardable material.	
Level 1	1–4	• Demonstrates limited knowledge and understanding, some of which may be inaccurate. • Applies understanding with limited coherence to produce a response that lacks development. • Demonstrates limited awareness of competing arguments. • Conclusion, if present, is generic or unsupported.	
Level 2	5–8	• Demonstrates knowledge and understanding, which is mostly relevant and may include some inaccuracies. • Applies understanding to make some coherent connections and a partially developed response. • Demonstrates some awareness of competing arguments, but this may be unbalanced, and partially supports conclusion with evidence.	
Level 3	9–12	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a fully developed response. • Demonstrates an awareness of competing arguments and supports conclusion with evidence.	
		Total for question 6	**12**

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