

Markscheme

May 2016

Computer science

Higher level

Paper 3

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General marking instructions

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.
2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.
3. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.** When marking **Question 4**, use the RM™ Assessor underline tool to underline key parts, and then use the textbox tool to add a comment stating which band the response is in, as well as any supporting explanation.
4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use RM™ Assessor annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.
5. Personal codes/notations are unacceptable.
6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, enter a zero in the mark panel on the right-hand side of the screen. Where an answer to a part question is worth no marks because the candidate has not attempted the part question, enter an “NR” in the mark panel on the right-hand side of the screen.
7. Ensure that you have viewed **every** page including any additional sheets. Please ensure that you stamp ‘SEEN’ on any page that contains no other annotation.
8. A mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the “CON” stamp.

Subject details: Computer science HL paper 3 markscheme**Mark allocation**

Candidates are required to answer **all** questions. Total 30 marks.

General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for that part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each statement worth one point has a separate line and the end is signified by means of a semi-colon (;).
- An alternative answer or wording is indicated in the markscheme by a “/”; either wording can be accepted.
- Words in (...) in the markscheme are not necessary to gain the mark.
- If the candidate’s answer has the same meaning or can be clearly interpreted as being the same as that in the markscheme then award the mark.
- Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have not achieved or what they have got wrong.
- Remember that many candidates are writing in a second language; be forgiving of minor linguistic slips. In this subject effective communication is more important than grammatical accuracy.
- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with “**FT**”.
- Question 4 is marked against markbands. The markbands represent a single holistic criterion applied to the piece of work. Each markband level descriptor corresponds to a number of marks. When assessing with markbands, a “best fit” approach is used, with markers making a judgment about which particular mark to award from the possible range for each level descriptor, according to how well the candidate’s work fits that descriptor.

General guidance

Issue	Guidance
Answering more than the quantity of responses prescribed in the questions	<ul style="list-style-type: none"> • In the case of an “identify” question read all answers and mark positively up to the maximum marks. Disregard incorrect answers. • In the case of a “describe” question, which asks for a certain number of facts <i>eg</i> “describe two kinds”, mark the first two correct answers. This could include two descriptions, one description and one identification, or two identifications. • In the case of an “explain” question, which asks for a specified number of explanations <i>eg</i> “explain two reasons ...”, mark the first two correct answers. This could include two full explanations, one explanation, one partial explanation <i>etc.</i>

1. (a) *In general, award [1 mark] for the action/processing taking place and [1 mark] for where it is happening;
For example:*

It evaluates / calculates (by integration) / finds etc. the total amount of light / radians / the intensity of the light (the radiance) / it is the integral equation that gives the light;

Being emitted from a point/surface (allow “bounces off”);

In order to determine the intensity/colour of each point;

It finds the sum of;

The light emitted and the light reflected from a point;

It is used to calculate how light interacts at each point;

In order to calculate the amount of light leaving the point;

It describes the conservation of energy / light (or equivalent);

For light entering and leaving a point/pixel;

[2]

- (b) *Award [1 mark] the idea that a cel contains part of a scene;
Award [1 mark] for the idea that cels can be combined or placed on a background to form a frame;*

For example:

Each cel is a transparent sheet which contains one element of a scene / that is drawn on (not rendered) / any example (**Note: do not accept verbatim answers from Case Study**);

Different cels can be overlaid / placed against a background to produce the complete scene;

This allows cels to be reused in other scenes;

Award both marks for any well-explained example;

[2]

2. (a) Award marks as shown below up to **[4 marks max]**.
Award **[3 marks max]** if the two processes are treated separately.
Note: Do not accept **verbatim** answers from the Case Study.

General Process

Tweening / Morphing / Both processes involve interpolating / producing intermediate frames between key frames / two frames;
Tweening / Morphing / Both techniques involve the use of corresponding points / avars / attributes (*note: can imply corresponding*);
In order to smooth the transition (between the start and finish frames) / to give the illusion of movement;

Application

Tweening produces in-between frames at different moments in the same scene / allow an example;
Whereas morphing produces intermediate steps between two distinctly different images / allow an example;

Note:

- Acceptable examples: Moving/scaling/rotating the same object (tweening); changing one face (object) to a different face (object) (morphing).
- Unacceptable examples (too vague): 3D animation (tweening); changing between two visual states (morphing).

Algorithms

Tweening involves different algorithms depending upon the attribute being addressed;
Morphing (algorithm) also involves distortion of the first scene/face to fit the shape of the second (distortion does not take place in tweening);

[4]

- (b) The uncanny valley is a feeling of unease felt by viewers;
When animation reaches a certain levels of realism;
That is between a “cartoon effect” and photorealism (or equivalent);
Animators must either stop short of this level / maintain a cartoon effect (allow example);
So that viewers empathise with the characters (**Note:** Do not accept **verbatim** answers from the Case Study);
Or go past it / create animation at a level of photorealism (allow example);
Only award a maximum of **[3]** if the qualifiers (or equivalent) of “cartoon effect” and “photorealism” are omitted.

[4]

3. Award up to **[6 max]**.
A diagram showing 2D array of squares / points (award for any valid diagram that illustrates any aspect of the fractal process);
Values are assigned to the four corners of the rectangle;
Mid-points are created;
The heights of these mid-points are calculated from the average of previous points;
Together with the introduction of “error” values / a random factor into the calculations;
The value of this error is gradually reduced;
The process is repeated (allow FT for wrong process) / recursion is used;
Process stops when all points have their values / when a certain “depth” in the algorithm has been reached;

[6]

Note: Do not award marks for the following copied from the case study:
“... and by varying the ‘error’ an infinite variety of designs can be created”.

4. *Discussion should focus on:*

- A comparison between the use of standard 3D modelling techniques using software / 3D scanning to produce the wire-frame models.
- A comparison with regard to animation techniques such as tweening and Mo-Cap
- A comparison between the use of scanline rendering and ray-tracing for the rendering of these models.
- The computer science details of how the above work.
- The processing power and overhead required for the above techniques.
- The limitations that arise from the market at which the project is aimed.
- A reasoned argument for deciding which is most appropriate for the company taking into the account:
 - The size of the company
 - The nature of the project.
- A suitable conclusion.

Marks	Level descriptor
No marks	<ul style="list-style-type: none"> • No knowledge or understanding of the relevant issues. • No use of appropriate terminology.
Basic 1 – 3 marks	<ul style="list-style-type: none"> • Minimal knowledge and understanding of the relevant issues. • Minimal use of appropriate terminology. • No reference is made to the information in the case study or independent research. • The answer may be little more than a list. • “Basic” responses will likely: <ul style="list-style-type: none"> • fail to address the choice of techniques • be verbatim from the case study • identify only some techniques • show minimal knowledge.
Adequate 4 – 6 marks	<ul style="list-style-type: none"> • A descriptive response with limited knowledge and/or understanding of the relevant issues. • A limited use of appropriate terminology. • There is limited evidence of analysis. • There is evidence that limited research has been undertaken. • The answer shows some understanding but is lacking in one or more of the issues. • “Adequate” responses will likely include: <ul style="list-style-type: none"> • an outline/description of some techniques • some attempt to justify choices • some explanation (towards the top end of this band).
Competent 7 – 9 marks	<ul style="list-style-type: none"> • A response with knowledge and understanding of the related issues. • A response that uses terminology appropriately in places. • There is some evidence of analysis. • There is evidence that research has been undertaken. • The answer shows a reasonable level of understanding of all related issues. • “Competent” responses will likely include: <ul style="list-style-type: none"> • explanations of at least 2 techniques or provide a detailed analysis • valid justifications • good comparisons • some attempt to discuss.

<p>Proficient</p> <p>10 – 12 marks</p>	<ul style="list-style-type: none"> • A response with a detailed knowledge and clear understanding of: <ul style="list-style-type: none"> – <i>the processes and technology involved in the modelling and rendering stages</i> – <i>the demands on resources</i> – <i>suitability of these processes for the specified project.</i> • A response that uses terminology appropriately throughout. • There is competent and balanced analysis. • There is clear evidence that extensive research has been undertaken. • “Proficient” responses will likely include: <ul style="list-style-type: none"> • a discussion • a reasonable explanation of all techniques • sound comparisons • justified decisions, regarding the company and product • a good conclusion.
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[12]

Total: [30]