SOLUTIONS

Module:	Interactive media design and production		
Module Code	EBU5305	Paper	A
Time allowed	2hrs	Filename	Solutions_1516_EBU5305_A
Rubric	ANSWER ALL QUESTIONS		
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Question 1

a) Digitisation.

[5 marks]

i) Let n be the number of bits used to quantise a digital sample. What is the maximum number of values that can be represented?

(1 mark)

Solution: 2^n

ii) Let f be the frequency of a sine wave. What is the minimum sampling rate that can be used in the digitisation process so that the resulting digitised wave is not aliased?

(1 mark)

Solution: 2f

iii) Calculate the size in bytes of a video file, which has the following characteristics: frame size is 300 pixels x 200 pixels, true colour encoding, frame rate is 25 frames/s, no audio track, duration is 1 minute.

(3 marks)

Solution: number of pixels per frame: 300 x 200 = 60 000; true colour is 24 bits per pixel; total number of frames: 25 x 60 = 1500. Size in bytes: 60 000 x 24 x 1500 / 8 = 270 Mbytes

b) Colour.

[5 marks]

i) Describe the properties of a fully saturated colour.

(1 mark)

Solution: a fully saturated colour contains no white

ii) In the RGB colour model, how is the grayscale represented?

(1 mark)

Solution: by one number only, as R = G = B

iii) What (R, G, B) values would you use to encode an unsaturated bright green colour?

(1 mark)

Solution: (50, 255, 50) (the R and B values must be the same, but any value between 5 and 250 is ok)

iv) What (H, S, V) values would you use to encode a fully saturated dark red colour?

(1 mark)

Solution: (0, 100, 20) (V can be any value between 5 and 45)

v) Magenta ink is spread onto a white sheet of paper. What colour will you see if the paper is illuminated with a green light?

(1 mark)

Solution: black

c) Image compression.

[5 marks]

i) What image property is used in Run Length Encoding (RLE) to achieve compression?

(1 mark)

Solution: spatial redundancy, i.e. the fact that large areas of the image are made of one colour.

ii) How would you encode the following sequence of bytes using RLE, and how much compression do you achieve?

Sequence of bytes: ABCCCAAAABBBBCCCCCDD

(3 marks)

Solution: ABCCC!4A!4B!5CDD which is 16 bytes instead of 20 bytes achieving compression of 20/16 = 1.25.

iii) What is the most efficient image compression technique for a vector-based image?

(1 mark)

Solution: a vector based image does not need to be compressed.

d) Consider the 4x4 matrix of DCT coefficients shown in Table 1 below.

[5 marks]

1000	**35**	**100**	**40**
100	**100**	**25**	**20**
75	**80**	**40**	**20**
20	**10**	**5**	**2**

Table 1

i) Apply quantisation to the DCT coefficients of Table 1, using the quantisation matrix shown in Table 2, and calculate a new matrix of rounded quantised values.

(2 marks)

10	**20**	**50**	**99**
20	**50**	**99**	**99**
50	**80**	**99**	**99**
99	**99**	**99**	**99**

Table 2

Solution:

100	2	2	0
5	2	0	0
1	1	0	0
0	0	0	0

ii) How many values have been rounded to zero? Where are they located in the new matrix and why?

(2 marks)

Solution: 9 values, all located in the lower right area of the matrix, this is because the quantisation table contains big values in the same area in order to eliminate the coefficients that correspond to high frequencies.

iii) To obtain a better quality image after decompression, what would you change to the quantisation matrix of Table 2?

(1 mark)

Solution: use smaller values in order to obtain less zeros during quantisation

e) MPEG.

[5 marks]

i) What type of MPEG frame is not temporally compressed?

(1 mark)

Solution: I-frames

ii) What is encoded after motion estimation has been successfully performed on a macro block?

(2 marks)

Solution: the error terms and the motion vector.

iii) Why are B-frames typically more compressed than P-frames?

(2 marks)

Solution: because they can make better predictions thanks to using two reference frames rather than one.

Question 2

a) Use of media.

[5 marks]

i) Sound can be disruptive. Explain how you can limit its disruptiveness.

(2 marks)

Solution: sound can be designed to be less disruptive, in particular its volume and its lead-in properties.

ii) How are colours best used to show contrast for details?

(2 marks)

Solution: to show contrast using colours, one should use different levels of brightness of the same colour, this is because the eye is very sensitive to various levels of brightness.

iii) Give one good use of video in multimedia.

(1 mark)

Possible solutions: to demonstrate a process, to show changes in real-time …

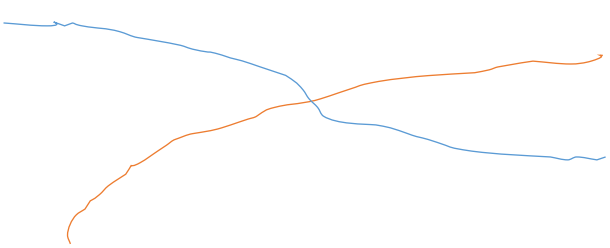
b) Design and human cognition.

[5 marks]

i) Explain the Gestaltists' law of good continuation and provide an illustration.

(3 marks)

Solution: the law of good continuation tells us that when there is an intersection between objects, viewers tend to see each object as uninterrupted. In the illustration, viewers see 2 segments and not 4.



ii) Explain the cognitive process of "recall".

(2 marks)

Solution: To recall is to retrieve information from long term memory and bring it to working memory so cognitive processes can be applied to it.

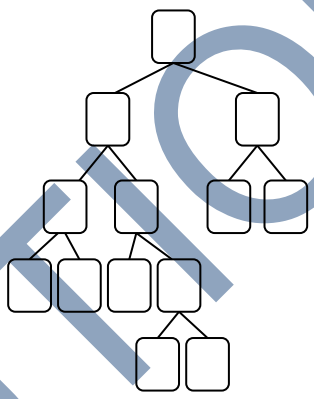
c) Structure and navigation.

[5 marks]

i) Explain what a deep structure is and provide an illustration.

(3 marks)

Solution: a deep structure is a structure that offers a small number of choices at each step but that requires a large number of steps to reach a given page. For example:



ii) In reference to your illustration of question i above, is the structure you drew well connected or sparsely connected? Justify your answer.

(2 marks)

Solution: sparsely connected because each page is only connected to two others.

d) Consider the image shown in Figure 1 (it is a screen shot of the top of the QMplus login page) and answer the two questions below.

[10 marks]

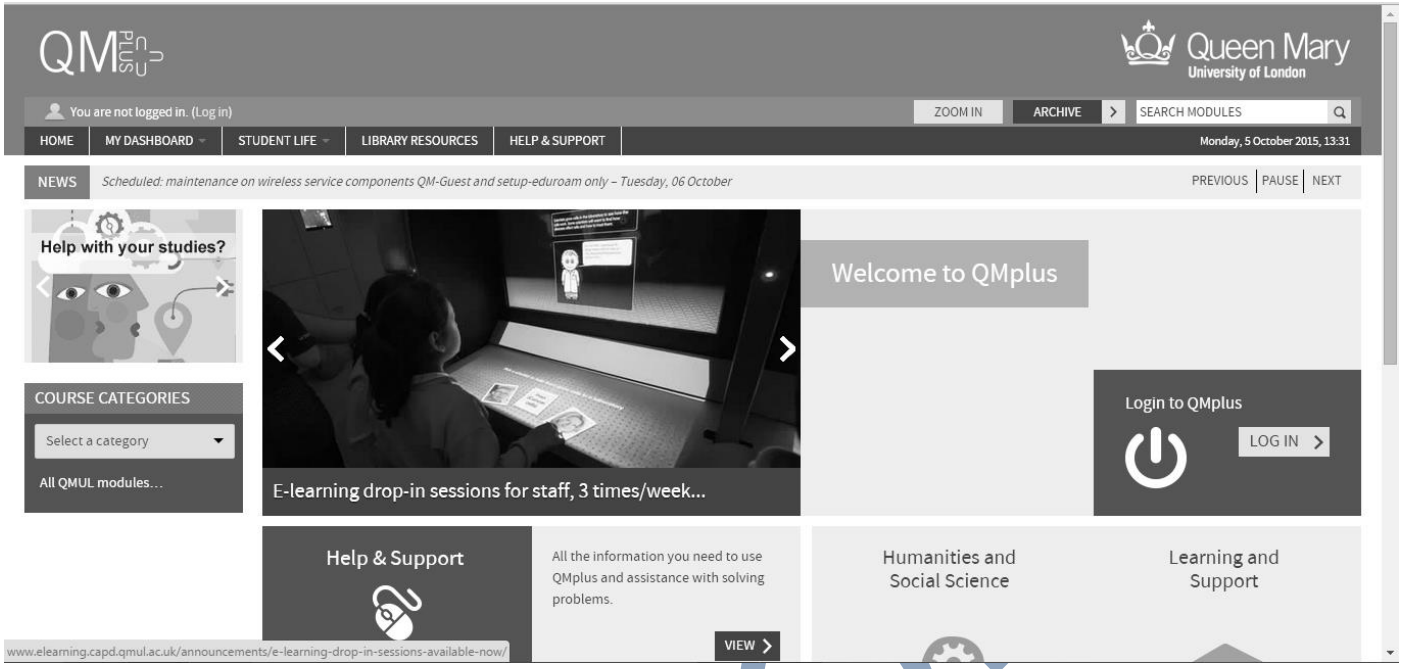


Figure 1

i) Comment the design of the web page shown in Figure 1 in terms of its layout, choice of media and usability. What is good? What is wrong?

(5 marks)

Possible solution: this is an open ended question. Students could mention the existence of three "log in" functions as a bad example of design (why three? Why in different locations?). They could also comment on the position of the "welcome to QMplus" message which should be the first design element viewers are presented with … etc.

ii) Suggest some possible improvements.

(5 marks)

Solution is open ended ..

Question 3

a) In the design process studied in class, what are the three steps of the information phase? Explain them briefly.

[5 marks]

Solution: (1) Determine goal of the project, i.e. answer the question "what is my application supposed to do?". (2) Gather data in target audience, i.e. who are the potential users, how are they going to access the application and in what kind of environment are they going to use it. (3) Select content for the project, i.e. what information will be given, through what media and how is it going to be grouped.

b) Storyboarding.

[10 marks]

i) What is a storyboard?

(3 marks)

Solution: Storyboards are visual organizers, typically a series of illustrations displayed in sequence for the purpose of pre-visualizing a video, web-based training, or Interactive Media sequence.

ii) During which phase of the interactive media design process is storyboarding useful?

(2 marks)

Solution: The interaction phase,

iii) In your opinion, what are the main differences between a storyboard for interactive media and a storyboard for animation movies, such as the one shown in Figure 2 below?

(5 marks)

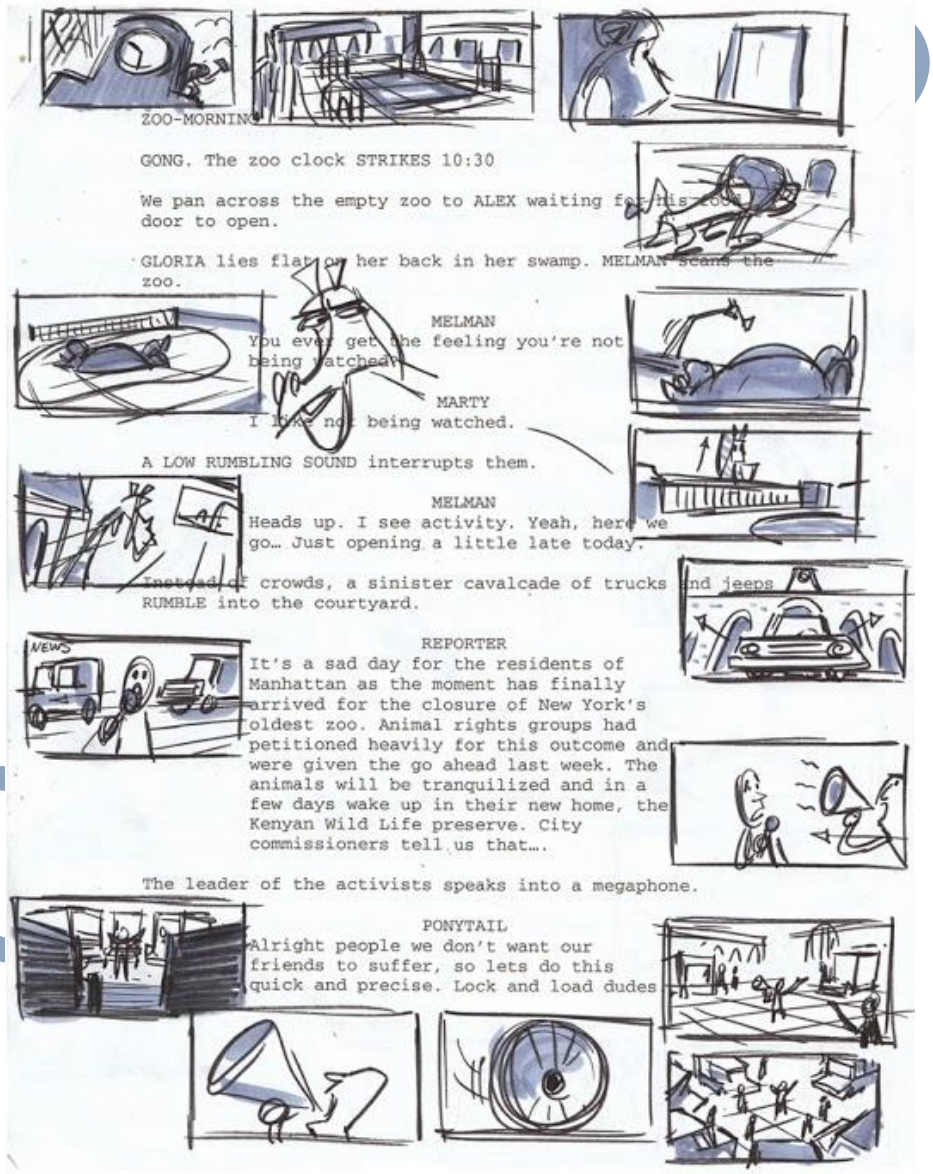


Figure 2

Solution: According to Figure 2, storyboards for animation movies mostly show how the story unfold together with the cript. Interactive Media storyboards may also contain animated stories but they must also show how users interact with the application as well as navigation information and media information.

c) You are part of a team who is designing an interactive media application to teach MPEG compression to students.

[10 marks]

i) During your first team meeting, you do a brainstorming session. What is the purpose of such a session and how should it be conducted?

(3 marks)

Solution: Brainstorming is a way to generate ideas within a group setting. It is usually used in the beginning stages of a project, where the possibilities for the project are not clearly understood or defined. Participation from everyone is encouraged and no idea is rejected in the first place.

ii) Your next team meeting is about building a mind map. Explain the purpose of this second meeting and how it relates to the outcome of the first one.

(3 marks)

Solution: Mind maps can be used to visualize, structure, and classify ideas that have been generated during the brainstorming session. It is an aid to studying and organizing information, solving problems, making decisions, and writing.

iii) Sketch your own mind map for an interactive media application that teaches MPEG to students.

(4 marks)

Solution: This is an open ended question … the proposed mind map should show the concept of MPEG in its center, then a number of branches showing elements of MPEG such as the various types of frames and the notion of temporal compression …

Question 4

a) Answer the multiple choice questions below by entering your choice (A, B, C or D) in the dedicated space (the small square that appears at the bottom right of each question). For each question, make only one choice.

[10 marks]

i) Consider Heuristic H1 (visibility of system status). Which good design below complies best with H1? A. A back button is provided on every page. B. A progress bar is provided to show downloading time. C. Short cuts are provided for expert users. D. Users can undo their actions at any time.	**Do not write in this column** **(2 marks)**
ii) Consider Heuristic H5 (error prevention). Which good design below complies best with H5?	

A. Mandatory fields are clearly indicated in the form.
B. A list of all possible options is provided in a list.
C. Complementary colours are not used in close proximity.
D. A progress bar is provided to show downloading time.

(2 marks)

iii) Consider Heuristic H6 (recognition rather than recall). Which good design below complies best with H6?

A. Users are notified when the caps lock key is on.
B. A back button is provided on every page.
C. A list of all possible options is provided in a list.
D. Short cuts are provided for expert users.

(2 marks)

iv) Consider Heuristic H8 (aesthetic and minimalist design). Which good design below complies best with H8?

A. Users can undo their actions at any time.
B. A progress bar is provided to show downloading time.
C. Complementary colours are not used in close proximity.
D. A back button is provided on every page.

(2 marks)

v) Consider Heuristic H9 (help users recognize and recover from errors). Which good design below complies best with H9?

A. Users are notified when the caps lock key is on.
B. A progress bar is provided to show downloading time.
C. Short cuts are provided for expert users.
D. Complementary colours are not used in close proximity.

(2 marks)

b) Answer the multiple choice questions below by entering your choice (A, B, C or D) in the dedicated space (the small square that appears at the bottom right of each question). For each question, make only one choice.

[10 marks]

i) Which of the following usability problems violates most Heuristic H2 (match between system and real world)? A. Users must re-type their name on every page. B. The delete icon shows an opened envelop. C. Users must type a file name to open it. D. There is no back button on the last page.	**Do not write in this column** **(2 marks)**
ii) Which of the following usability problems violates most Heuristic H3 (user control and freedom)?	

A. The exit button is coloured green.
B. The home button is sometimes on the right, sometimes on the left side.
C. <u>There is no back button on the last page.</u>
D. The front page has no title.

(2 marks)

iii) Which of the following usability problems violates most Heuristic H4 (consistency & standards)?

A. There is a horizontal scroll bar.
B. The logo of the company is animated on every page.
C. <u>The home button is sometimes on the right, sometimes on the left side.</u>
D. There is no back button on the last page.

(2 marks)

iv) Which of the following usability problems violates most Heuristic H7 (flexibility and efficiency of use)?

A. The front page has no title.
B. <u>Users must re-type their name on every page.</u>
C. The exit button is coloured green.
D. The delete icon shows an opened envelop.

(2 marks)

v) Which of the following usability problems violates most Heuristic H8 (aesthetic and minimalist design)?

A. There is a horizontal scroll bar.
B. Users cannot undo their actions.
C. <u>The logo of the company is animated on every page.</u>
D. There is no back button on the last page.

(2 marks)

c) Consider the dialogue window shown in Figure 3.

[5 marks]

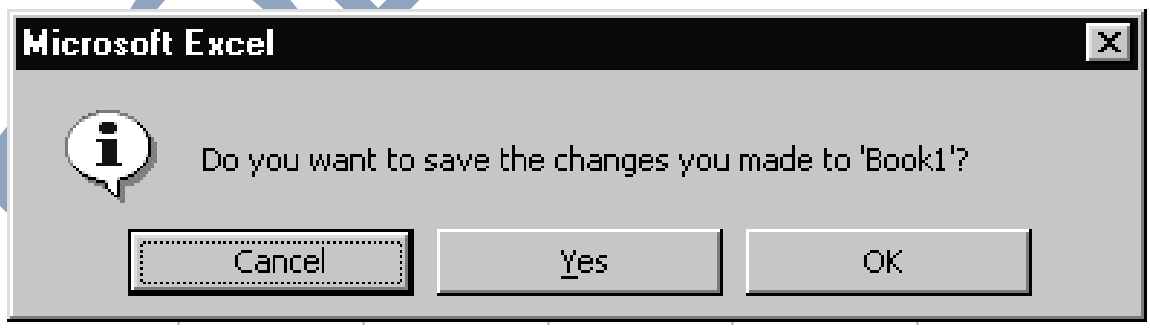


Figure 3

i) Describe the usability problem and give the heuristic it violates.

(3 marks)

<u>Solution: the labels on the buttons are confusing and error prone, what is the difference between yes and OK? This is an "error prevention" problem (H5)</u>

ii) What severity factor would you assign to the usability problem you described in question i above?

(1 mark)

Solution: the severity is 3 (major usability problem)

iii) Suggest a solution.

(1 mark)

Solution: use the following labels: No , Yes , Cancel