UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 1999/2000

February 2000

CSI534 - Multimedia in Education

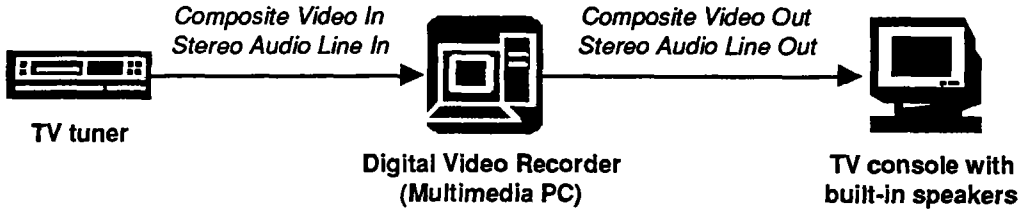
Duration : [3 hours]

INSTRUCTION TO CANDIDATE:

- Please ensure that this examination paper contains **FIVE** questions in **FIVE** printed pages before you start the examination.
- Answer **ALL** questions.
- You can choose to answer either in Bahasa Malaysia or English.
- This is an Open Book Examination.

ENGLISH VERSION OF THE QUESTION PAPER

1. A Prototype Digital Video Recorder (DVR) is being developed using a multimedia capable PC. The DVR is intended to replace existing video tape-based Video Cassette Recorders (VCR) by using a fast hard disk as storage medium for television content to be recorded. The TV transmission is PAL standard format. The DVR has to accept a composite video input and a stereo audio line input from a TV tuner (similar to those used for cable TV such as Astro). In addition, the DVR has to provide a composite video output jack and a stereo audio line out jack that can be attached to a TV console with built in speakers.



(a) Given that the DVR is created using a multimedia PC architecture, what are the necessary hardware components that should be present in the PC in order for it to function as a DVR?

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(b) If the incoming PAL standard video stream uses an image size of 720 x 576 pixels per frame, what amount of storage is required for:

(i) one frame of uncompressed PAL standard video in 8-bit RGB format

(ii) one frame of uncompressed PAL standard video in 8-bit YUV format using 4:2:2 subsampling

(iii) 30 seconds of uncompressed PAL standard video in 8-bit YUV format using 4:2:2 subsampling

(iv) 30 seconds of uncompressed stereo sound sampled at 16 bit 44.1 kHz (CD quality)

(8/20)

(c) Compression is used on the PAL standard video stream in order to reduce the amount of storage required. Two alternatives are available: Motion JPEG (M-JPEG) which compresses each frame individually using the JPEG algorithm, and MPEG-2.

(i) Which algorithm gives better overall compression? Why?

(ii) Which algorithm is more susceptible to errors in the video stream playback if some of the data on the disk is corrupted and cannot be read? Why?

(iii) If the MPEG compression for the TV signal (audio and video) requires a data rate of 2 Mbps, what storage capacity is needed in the DVR in order to record a 4 hour long program?

(8/20)

2. A web-based journal for photography enthusiasts is being planned. The web-designer has a choice of several file formats for the graphic illustrations to be used on the website. Illustrations consist of various clip-art, as well as sample photographs. The file formats that can be utilized are: 8-bit GIF, JPEG, and 24-bit uncompressed TIFF.

   (a) (i) Explain the difference between vector graphics and bitmap graphics.

   (ii) What happens when a bitmap graphic is enlarged?

   (3/10)

   (b) Which file formats are most suitable for storing the following and why?

   (i) clip art that are used to decorate the website.

   (ii) color photograph thumbnails (smaller version of the actual image) used as a quick guide to browse the online photograph library.

   (iii) full sized full color images that should be of the highest possible quality scanned from the original photographs.

   (iv) 16-color navigation buttons used to access different parts of the website.

   (7/10)

3. A server S is used for webcasting live soccer events to various clients connected through the Internet. At this given moment, X_1, X_2, X_3 and X_4 are receiving the webcast from the server S. There are three video camera equipped capture workstations C_1, C_2, and C_3 located at the football stadium, each transmitting its raw multimedia streams, containing video and audio (A_{Ci} and V_{Ci}, i = 1, 2, 3) to the server S. The server multiplexes the three incoming raw multimedia streams into a single display multimedia stream containing video, audio and text captions (A_{Dj}, V_{Dj} and T_{Dj}, j = 1, 2, 3, 4) for transmission to each client.

   (a) Draw a diagram with the correct number of Synchronous Channel Groups (SCG) from the three capture workstations to the server, and the server to the four clients. Indicate the direction of data flow, the information stream (A_{Ci}, V_{Ci}, A_{Dj}, V_{Dj}, T_{Dj}) contained in the respective SCG, as well as the source (SCG+) and destination (SCG-) for each SCG.

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   (b) Using a Temporal Relationship Diagram (TRD), sketch the following program sequence for the soccer webcast:

   The webcast starts up and displays a Title screen (T_{DA}) for 5 seconds. A sports commentator comes on immediately via the first camera following the title screen, giving a summary of the teams and players (V_{DB}, A_{DB}) until the match begins 30 seconds from the beginning of the webcast. The commentator's voice can be heard throughout the webcast. The second camera located at the field provides a good view of the starting kick (V_{DC}), during the time the commentator describes the action on field, which lasts for another 60 seconds. The action then switches to the third camera (V_{DD}, A_{DD}) located at the goal at the end of that time, as the home team has scored a goal. The noise of the crowd can be heard as the commentator announces the score. The third camera is enabled for 15 seconds, after which the program returns to the commentator, and the score is overlaid on screen (T_{DE}) together with the video of the commentator (V_{DE}) for 10 seconds as he gives the summary of the match so far.

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(c) Given that each raw multimedia streams containing A_{Ci} and V_{Ci} require a bandwidth of 1 Mbps for audio and 35 Mbps for video respectively.

(i) What type of networking technology is able to provide the bandwidth needed to support the transmission of three raw multimedia streams to the server given that the workstations and server are located on the same network?

(ii) If the server is able to perform 100:1 compression on the audio and 800:1 compression on the video, what is the required bandwidth per client in order to receive the display multimedia stream derived from one raw video stream and two raw audio streams? Assume that the two audio streams are not mixed together after compression and that text captions require negligible bandwidth for transmission.

(iii) Would a home user equipped with an ISDN modem be able to receive the webcast? How about another user equipped with a V.90 (56Kbps) modem?

(5/20)

4. The Ministry of Education would like to develop a Computer Based Instruction courseware: Introduction to Information Technology. When completed, the system will be pressed on CD-ROM and will be used in the Primary School in Malaysia.

(a) Describe the steps you will take in planning the development of the proposed application.

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(b) What type of information is required to characterized the audience of the proposed application? Provide some example.

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(c) Using one of the hypermedia design techniques, prepare a general system organizational structure for the multimedia system above. Explain why you choose the design technique.

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(d) Discuss the rules for properly design instructional interfaces for the above system. Based your answer on the psychology of learning.

(5/25)

(e) Briefly explain the learning strategies that you will use for the above system. Lists all the system functions that you will incorporate in this application.

(6/25)

5. (a) Based on Macromedia Director 7.0; answer the following questions:

(i) A sound "Ping Sound" has been imported into the cast member 20. Write a lingo to play the sound (without bringing it into the sound channel in the score).

(ii) A movie has 30 cast members. Write a lingo that will optimize this movie performance.

(iii) Write a lingo that will display today's date (eg. Friday, December 31, 1999).

(iv) Write a lingo that will cause a dialog box to appear with the following text - "Sorry, wrong answer".

(v) Show how you create a text hyperlinks that will navigate you to another page.

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(b) What kind of information should be included in the application documentation?

(4/25)

(c) Your multimedia production company was awarded a contract to develop a series of application for an entertainment company. The proposed application will required intensive use of computer animation, audios, and videos and the product will be delivered in kiosks.

(i) Describe the process you would use to identify the equipments necessary in the production and delivery of the application.

(ii) List all the equipments required for the above project. Justify your requirement.

(iii) How would you determine which multimedia-authoring tool you should use for the above project?

(iv) Which multimedia elements you should use in this project?

(5/25)

(d) How would you determine the suitability of a particular multimedia element in a multimedia application?

(4/25)

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