THE UNIVERSITY OF HULL

Department of Computer Science

Level 6 Examination

2013

Visualization

Monday, 13 May, 9.30 am to 11.30 am
(2 hours)

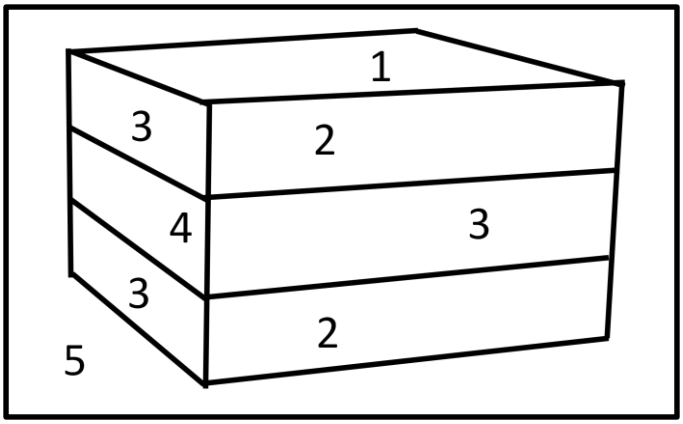
Answer ALL questions
(Each question is out of 20 marks)

Please use the supplementary paper sheet to answer question 2(ii) and the tracing paper for question 2(v)

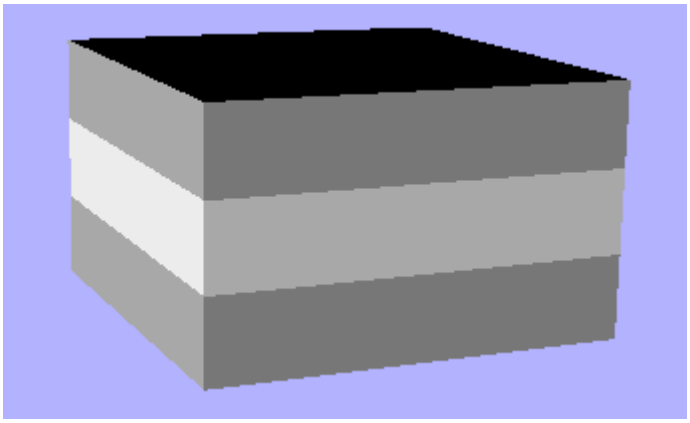
Do not open or turn over this exam paper, or start to write anything until told to by the Invigilator. Starting to write before permitted to do so may be seen as an attempt to use Unfair Means.

[08965]

1 (i) Derek is helping his little boy Damien with his latest 'Painting by Numbers' set but they think they haven't been given enough different shades of grey (colours numbered 2-4 on the key, A) to complete the picture as it appears on the box lid (B).



A



B

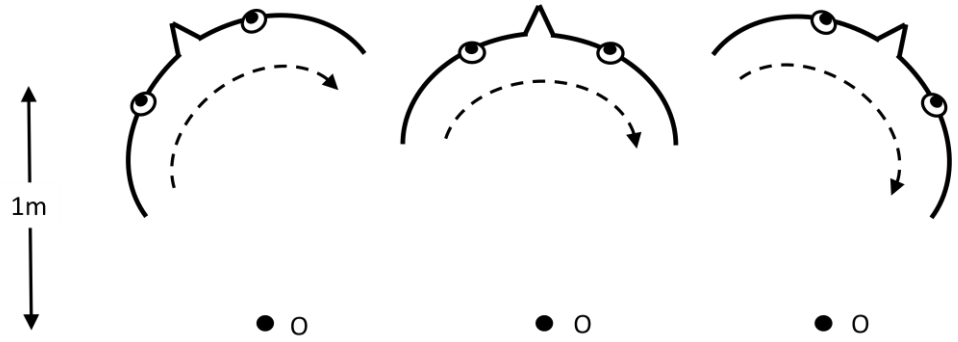
Referring to the numbers in the key and the apparent colours on the box, how would Derek describe his concerns about the painting set to the manufacturer? [2 marks]

(ii) What simple experiment could the manufacturer suggest Derek and Damien carry out, before even starting the picture, which would convince them the colour key is correct? [2 marks]

(iii) One theory explaining perception suggests we integrate various factors in order to construct a visual hypothesis of what we see. Draw a diagram showing how these factors are combined and give an example of each type of factor, as experienced by Derek and Damien when they look at the object in the picture. [6 marks]

1 (continued)

(iv) The diagram shows a plan view of a concave face progressively turning clockwise about 1m in front of a stationary observer, O.



Draw a corresponding plan view showing what the observer may perceive and describe what they 'see', in words. With reference to your diagram in (iii), classify one factor contributing to, and one detracting from, the illusion that might be experienced. [8 marks]

(v) Based on your analysis in (iv) of the factors at work, suggest and justify a change to the set-up in (iv) to assist in experiencing the illusion. [2 marks]

2 (i) Describe how star plots are used to display multivariate data. [3 marks]

(ii) The table below gives five data values for each one of four passenger coaches. Plot the data on the paper template provided. Be sure to put your student number on the template and attach it to your script for collection later.

Running cost (£pw)	**Number of seats**	**Price (£k)**	**Length (m)**	**Petrol tank (L)**
20	24	25	5	3000
10	18	20	7	4000
30	12	30	6	3000
20	24	25	8	2000

[5 marks]

2 (continued)

(iii) Do star plots chiefly give object visibility, or attribute visibility? Justify your answer. Compare star plots with a different multivariate data visualization technique that chiefly gives the alternate type of visibility (i.e. ‘attribute’ if you responded ‘object’, or ‘object’ if you responded ‘attribute’). [3 marks]

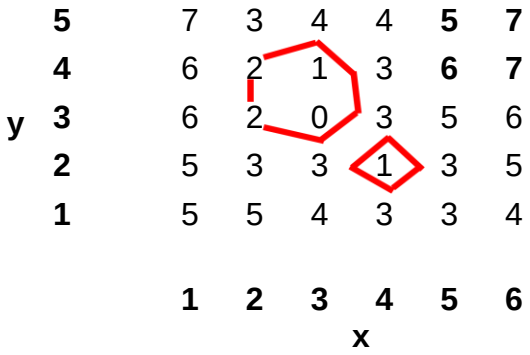
(iv) Describe what is meant by ‘brushing-and-linking’ in information visualization. [2 marks]

(v) A tour company uses your plot to choose a new coach for their holidays in the Ardeche. The roads there are narrow and winding, so they cannot take any vehicle longer than 6.5m. At the same time, they need to spend less than £15 per week to run it. Mark out a brush on the tracing paper provided and then apply it to pick out candidate vehicles. Tick coaches that qualify and cross those that do not. Be sure to put your student number on the brush and attach it to your script for collection later. [5 marks]

(vi) How would you implement the brushing technology to allow the company to relax their running cost requirement, and which would be their first or next choice of vehicle if they could do so? [2 marks]

3 (i) Describe how you would generate a contour representation of gridded data using the *marching squares* method. [3 marks]

(ii) Applying the method to the data below for a contour with value 2 gives the result shown. Explain why this representation is not the best one for this data. Sketch and justify an alternative. [4 marks]



(iii) Compared with the line segments of a contour plot, the geometric primitives making up a surface view make it particularly easy to use lighting, shading, and colour, to good effect.

(a) Describe how you would generate a surface view of this data and illustrate your answer using the grid cell highlighted in bold at the top-right of the figure. [5 marks]

(b) Sketch the appearance of the surface view of the data in the figure from a viewpoint at the bottom-right looking towards the top-left, in the presence of a light above the bottom-left shining towards the top-right. What insight may be gained from such a visualization, compared with a contour plot? [4 marks]

(c) Describe and justify two ways in which colour could be used with this surface view. [4 marks]