University of Cape Town
Department of Computer Science

Computer Science

CSC4000W: Visual Thinking for Design
Final Exam May 2012

Marks: 50

Time: 2 hours

- Approximate marks per question are shown in brackets

- The use of calculators is permitted

Surname   Initials
NAME:
STUDENT NO: **COURSE CODE:** CSC

This paper consists of 4 questions and 4 pages (including this cover page).

Mark Allocation							
Quest	Marks	Internal	External	Quest	Marks	Internal	External
1	[13]			3	[12]		
2	[15]			4	[10]		
	Total				**Total**		
				Grand Total			
				Final Mark			
Internal Examiner:				**External Examiner:**			

Question 1.   **[13 marks]**

a) Explain how we as humans perceive the world around us. In your answer, describe in general terms our current understanding of the human visual system, including the bottom-up and top-down processes of perception.   [10] **Solution:** *At any given instant, we apprehend only a tiny fraction of the information stored in our surroundings[1]. We have limited capacity for attention and unnecessary information is discarded [1] "The world is it's own memory". [1] We are not immediately conscious of the world: we are conscious of the field of information to which we have rapid access[3] Visual thinking consists of a series of acts of attention - visual queries[1] perception is driven by 2 processes: bottom-up: retinal image -¿ features -¿ patterns -¿ objects*

top-down or attention: driven by need to accomplish some goal biased in favour of signals we are looking for only get information we need when we need it sequence of rapid eye movements to locate important objects

b) *In this context, explain how gist-object conflict helps advertisers capture our attention.   [3]* **Solution:** *We constantly survey our surroundings, even though we may not be conscious of it. Object of interest attract our attention. [1] Gist refers to our ability to recognise a scene as a pattern - e.g. beach/forest - within a fraction of a second. [1] Objects can be recognised as quickly. A gist-object conflict is an object placed inapproapriately in a scene - e.g. a horse in a swimming pool. [1] This creates a graphic puzzle, which gains our attention (top-down process) in order to solve it. [1] Attention is what advertisers are looking for.*

Question 2. Examine the graphic in Figure 1 and answer the questions below. [15 marks]

a) Graphically distinct objects vary according to colour, orientation, size, motion and stereoscopic depth. Why should objects in a graphic be made distinct? [3]

Solution:

Goal is to design displays so that visual queries are processed both rapidly and correctly for every important cognitive task. The most important and frequent queries should be supported by the most graphically distinct objects.

b) Is colour used effectively in Figure 1? Justify your answer. [3] **Solution:**

How is colour used? - Colour is used to locate continent/region, with saturation separating the countries in a region.[1] Colour is also used to reference the graphs below the main figure, as well as the small key to the world in it's usual depiction. [1] Colours next to each other are visually separate in order to separate regions - this is quite effective.[1] However, countries are identified less easily by colour intensity and location.[1] Colour is NOT used symbollically in this graphic - red does not mean "more"/"higher".[1]

c) Is size used effectively in Figure 1? Justify your answer. [3]

Solution:

How is size used? - size is used to show population size[1]. This is quite effective for querying the most highly and most sparsely populated countires.[1] However, it is less effective for the small countries, which disappear[1], and for relative comparisons of country size.[1] It is hard to estimate the poluation of a country from its size.[1] Size also distorts a country, making it hard to identify (e.g. Australia).[1]

d) Could the use of texture improve this graphic? Justify your answer. [3]

Solution:

What options are there for the use of texture? - lines of spots or curves etc[1]
What could you use it for? This could be used to show new information (e.g. population density)[1] or to emphasies other information (countries with the largest population)?[1]
Would this work? - probably for the big countries, but there is little room for the smaller countries to show texture.[1]

e) Could the use of depth cues improve this graphic? Justify your answer. [3]

Solution: *Depth is less important than the other dimensions, but can be effective.[1] Pictorial depth cues that could be could be used are:*
occlusion - maybe for extra information (e.g. population numbers or names) superimposed on country[1], but can't really be used as the map is fixed perspective - not likely to be effective, as we can't move object higher up the plane[1] or into 3D (linear perspective)[1] shading - could be used to make a country stand out more - identify the country with highest population, or top 10 etc. [1] distance blurring or reduction of contrast is unlikely to work as this is an inherently 2D map.[1] stereoscopic depth is unlikely to be useful.[1]

Question 3. Examine the graphic in Figure 2 and answer the questions below. [12 marks]

a) A good graphic enables visual queries to be processed rapidly. **For Figure 2**, list two distinct visual queries that are likely to be processed rapidly by our visual cortex. Justify your answers. [4]
   Solution: *These should be QUERIES. eg.*
   Which country eats the most meat.[1]
   Which country eats the least meat.[1]
   Top ten/ bottom ten carnivourous countries.[1]
   Size is easy to compare.[1]

b) Now list two distinct visual queries for Figure 1 that are likely to be processed more slowly. Justify your answer. [4]
   Solution: *These should be QUERIES. eg.*
   Is country X represented? - will have to scan through the whole list. [2]
   Does Spain or the USA consume more meat? - will have to locate those two countries and then compare the text - the relative sizes are hard to determine. [2]

c) E. R. Tufte said that:
   There are right ways and wrong ways to show data; there are displays that reveal the truth and displays that do not.
   In your opinion, does **For Figure 2** show the data a right way or a wrong way? Justify your answer. [4]
   Solution: *Well justified argument, using the details of the graphic. It's clearly a bad graphic for various good reasons, but positive comments get marks if reasoned well.[4]*

Question 4. [10 marks]

Examine the graphic in Figure 3. Your task is to redesign and improve this graphic: try to make at least 3 improvements to the design. For each design decision, explain why the original was imperfect and justifying your improvement in terms of your knowledge of the way our visual system works and what makes graphical objects distinct. You may use diagrams in your answer. [10]
Solution: *The major issues with this graphic that could be fixed are:*

- *FInding the current number of programs in the state. This is shown by colour. However, the colour mapping in the graphic is strange - requiring constant reference to the key. A heat map (in this, NOT ALL cases) would be better, moving from a cold colour to a warm colour for higher numbers of WAP programs. Or else including the number or programs in the state (there is room for this). Or another idea.*

- *The difficulty of comparing the two maps. This can be fixed to some extent by colour, but other ideas (bars on a single graph), numbers etc could help.*

Other good ideas that service clear visual queries and are well justified get marks too, such as improving the background/text luminence contrast for the few states where there is a problem, or or the number of current and previous programs in the state, or using texture to indicate the highest states
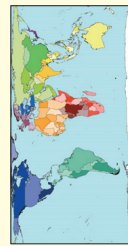
Total Population
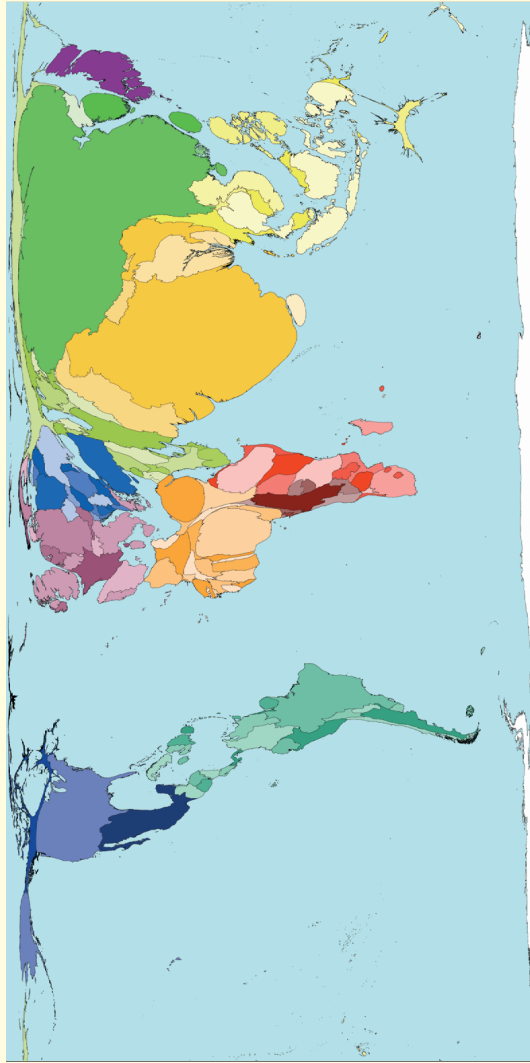
In Spring 2000 world population estimates reached 6 billion; that is 6 thousand million. The distribution of the earth's population is shown in this map.

India, China and Japan appear large on the map because they have large populations. Panama, Namibia and Guinea-Bissau have small populations so are barely visible on the map.

Population is very weakly related to land area. However, Sudan, which is geographically the largest country in Africa, has a smaller population than Nigeria, Egypt, Ethiopia, Democratic Republic of Congo, South Africa or Tanzania.

The size of each territory shows the relative propotion of the world's population living there.

WORLD POPULATION BY REGION

Regional population (millions) / Year
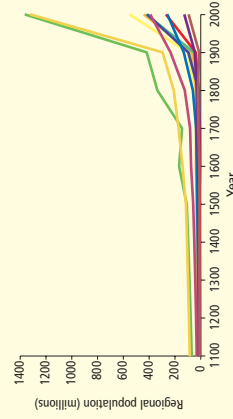
"Out of every 100 persons added to the population in the coming decade, 97 will live in developing countries."

Hania Zlotnik, 2005

Map 002

Land area

Technical notes
- Data source: United Nations Development Programme, 2004, Human Development Report.
- Population data is from 2002
- The population not included is estimated as 2 to 3 million (see Appendix map 2).
- See website for further information.

MOST AND FEWEST PEOPLE

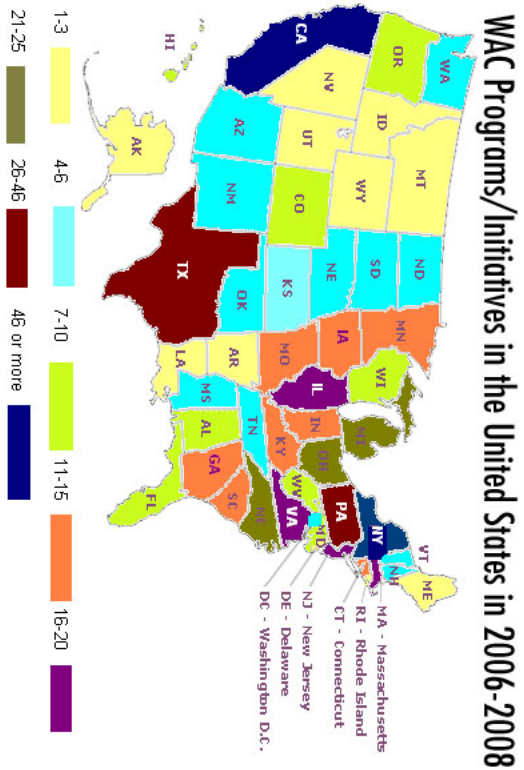| Rank	Territory	Value	Rank	Territory	Value
1	China	1295	191	Saint Kitts & Nevis	42
2	India	1050	192	Monaco	34
3	United States	291	193	Liechtenstein	33
4	Indonesia	217	194	San Marino	27
5	Brazil	176	195	Palau	20
6	Pakistan	150	196	Cook Islands	18
7	Russian Federation	144	197	Nauru	13
8	Bangladesh	144	198	Tuvalu	10
9	Japan	128	199	Niue	2
10	Nigeria	121	200	Holy See	1

millions / *thousands*

Figure 1: This may be detached from the exam, for ease of reference.

Figure 2: The COW one.

5

WAC Programs in the United States in 1987

WAC Programs/Initiatives in the United States in 2006-2008

1-3
4-6
7-10
11-15
16-20
21-25
26-46
46 or more

MA - Massachusetts
RI - Rhode Island
CT - Connecticut
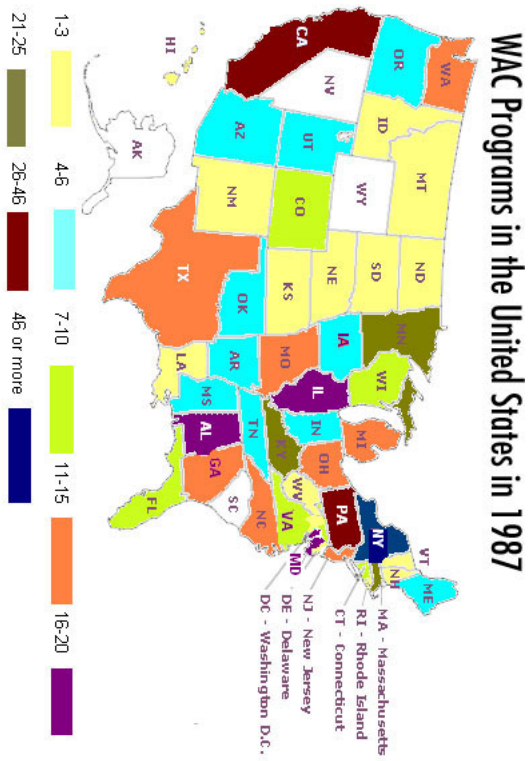NJ - New Jersey
DE - Delaware
DC - Washington D.C.

Figure 3: This may be detached from the exam, for ease of reference.