UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Level

THINKING SKILLS **9694/04**

Paper 4 Applied Reasoning **October/November 2009**

1 hour and 30 minutes

Additional Materials: Answer Booklet/Paper

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Electronic calculators should be used.

Answer **all** the questions.
Start each question on a new answer sheet.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question.

This document consists of **11** printed pages and **1** blank page.

1 *Study the following evidence and answer the questions which follow. Show your work.*

The producer of a local radio station is required to balance the need to attract listeners with the need to attract money from advertising. A recent survey of the preferences of listeners revealed the following trends during the one hour breakfast slot.

Entertainment and the number of listeners

The breakfast show is the first show of the day. Before the beginning of the show, therefore, there are no listeners. Different types of entertainment had predictable effects on the number of listeners to the show.

Chat: Attracted an extra 50 listeners every minute on average.

Music: Attracted an extra 100 listeners per minute on average.

Adverts: One minute of adverts reduced the number of listeners by 10%. Each minute after that lead to the same reduction in the number of listeners. For example, if the audience was 2750 when the adverts began then each minute of adverts cost the station 275 listeners.

For commercial reasons it has been decided that all adverts are to be broadcast in the one section at the end of the hour.

Financial implications

The financial implications of the different types of entertainment are as follows.

- Periods of chat are free.
- Periods of music cost \$2 per minute in licence fees.
- Periods of advertising earn the radio station \$20 per minute.

Producer's constraints

- The producer must ensure that no programme makes a loss. In other words, the cost of the music must not exceed the income from advertising.

- The producer requires that the estimated number of listeners at the end of the show is at least 3000. [This is the number achieved by a radio show consisting of only chat.]

Throughout the questions that follow, you need only consider <u>whole</u> numbers of minutes. All proposed solutions must abide by the producer's constraints.

(a) Show that if one minute of adverts was broadcast at the end of the hour and the \$20 of income was all spent on playing music then there would be an estimated 3105 listeners at the end of the show. [2]

(b) Find the maximum number of minutes of adverts that can be broadcast (and still attract 3000 listeners). Justify your answer. [3]

(c) Find the maximum number of listeners that could be attracted to the show. [1]

(d) Find the maximum profit that can be made from the breakfast show and state how long should be spent on the different types of entertainment to achieve this. The number of listeners does not need to be maximised, but must be at least 3000 at the end of the show. [Profit = income minus costs.] [4]

2 *Study the following evidence and answer the questions which follow. Show your work.*

The Supplementary Vote (SV) is one of a number of voting systems in operation around the world. SV is conducted as follows:

- There are two columns on the ballot paper for voters to indicate their first and second choices (though it is not obligatory to make a second choice).
- Voters' first choices are counted. The two highest scoring candidates go forward to a second count and the rest are eliminated.
- The second preferences of the voters whose first-choice candidates were eliminated are examined; any of these second-choice votes that were cast for candidates that have gone forward are given to them. Whoever has the most votes at the end of the process is the winner.

The Palindrome Club uses the SV system to elect its Chairman, Secretary and Treasurer each year. Here is this year's ballot paper, which includes the nominations for all three positions.

Chairman	**1st Choice**	**2nd Choice**
Emma Amme		
Colin Niloc		
Liam Mail		
Eileen Neelie		
Albert Trebla		
Secretary	**1st Choice**	**2nd Choice**
Stella Allets		
Liam Mail		
Eileen Neelie		
Len Nel		
Treasurer	**1st Choice**	**2nd Choice**
Emma Amme		
Adam Mada		
Liam Mail		
Olwen Newlo		

Under the rules of the Club a member may stand for two or all three positions at the same time but cannot be elected to more than one, so the counts are conducted in the following way.

- The votes for Chairman are counted first, the winner being elected to the position.
- The votes for Secretary are counted next. If the newly elected Chairman has stood for Secretary he or she will be eliminated after the first count regardless of first choice votes received. In this case, the two highest scoring candidates (except the Chairman) will proceed to the second round.
- Likewise, when the votes for Treasurer are counted, any candidate already elected as Chairman or Secretary will similarly be eliminated after the first count.

Voting closed a short time ago. This is a summary of the votes cast.

Chairman
1st Choice

2nd choice	Emma Amme	Colin Niloc	Liam Mail	Eileen Neelie	Albert Trebla
Emma Amme		5	4	8	(2)
Colin Niloc	8		5	6	7
Liam Mail	6	8		2	4
Eileen Neelie	5	3	4		8
Albert Trebla	6	4	6	7	
No 2nd choice	2	0	1	2	2

This means there were 2 ballot papers in which Trebla was put as 1st choice and Amme as 2nd choice.

Secretary
1st Choice

2nd choice	Stella Allets	Liam Mail	Eileen Neelie	Len Nel
Stella Allets		9	10	9
Liam Mail	6		8	7
Eileen Neelie	5	7		8
Len Nel	9	11	9	
No 2nd choice	3	2	2	4

Treasurer
1st Choice

2nd choice	Emma Amme	Adam Mada	Liam Mail	Albert Trebla
Emma Amme		6	8	9
Adam Mada	8		10	7
Liam Mail	5	8		8
Albert Trebla	9	12	7	
No 2nd choice	3	2	3	2

(a) Who was the most popular second choice for Chairman? [1]

(b) All 115 members who submitted ballot papers took part in the vote for Chairman. A number of these members did not register even a first choice for Secretary and/or Treasurer.

(i) How many members who submitted ballot papers did **not** vote for Secretary? [1]

(ii) How many members who submitted ballot papers did **not** vote for Treasurer? [1]

(c) **(i)** Which **two** candidates will go forward to the second count for Chairman? [1]

(ii) State clearly the total vote for each of the two candidates, including the second count. [2]

(d) **(i)** Who will be elected Secretary? [2]

(ii) Who will be elected Treasurer? [2]

Show your working clearly.

3 **(a)** Provide a brief analysis of the argument by Ziauddin Sardar in Document 1. [4]

(b) Give a critical evaluation of the reasoning in Document 3 (*GGP as never be*... commenting on its strengths, weaknesses and any implicit assumptions it makes.

(c) *'Fifty years from today, world civilization will have progressed so steeply that the poorest nations will be as rich as the richest nations of today, and health and prosperity will be accessed by every person in the world.'*

Commenting critically on some or all of Documents 1-5, and introducing ideas of your own, argue **either** for **or** against this prediction of the condition of humanity in fifty years time. Construct a well-reasoned case supporting a clear conclusion.

You may wish to consider how policies and/or global trends will have led to the outcome. [20]

DOCUMENT 1

Walk with your back into the Future

The contemporary way of looking at the future, as established by the academic study of the futu known as 'futures study', needs to be reviewed.

According to the huge Whitehall Foresight[1] programme, designed 'to make the future work for you', the technological mirror of the future shows a time when robots will have the vote, we will go for holidays on the moon, and the world will have splintered into currency blocs. They say that we should see, in front of us, endless broadband, computer-brain interface and immortality. This is the picture of the future presented to English speakers by Whitehall's 'Foresight'. But this is ingrained in conventional Western wisdom which teaches the future lies in front of them: the time yet to come.

The humble speakers of Aymara, a native language of the High Andes, can make us think again. The future, they say, lies not in front of us but behind us. It is the past that is actually in front of us. When speaking they gesture with their hand ahead of them when remembering things past, and backward when talking about the future. The past is known, so it lies in front. The future is unknown so it lies where you cannot see it, i.e. behind you. This fundamentally different way of looking at the future is a more accurate approach. What the Aymara teach us is that the future cannot be known apart from the past.

The Whitehall programme examines relatively past and current trends in science and technology, politics, the economy and society in order to extrapolate them for the future. This comprises only selective modern aspects of history which is not sufficient to predict the future of humanity. All we learn is that we will enjoy more of the wonders of technology - a projection of past technology into future technology. Whitehall Foresight does not constrain us to look honestly and deeply enough into the past.

How can we understand the future when all the images of it are derived from modern technology alone? Our modern world has trapped us in a spiral with no direction. All we see before us is a one-dimensional track of technological progress for its own sake. This is shown by our readiness to abandon time-honoured past values that remind us who we are and what it means to be human. Surveys have suggested most of us in the West do not even know what it means to live a life worth living.

The Aymara speakers remind us of John Lennon who sang: 'How can I go forward when I don't know which way I'm facing?' The current 'futures' approach is pointing us in the wrong direction.

Ziauddin Sardar

[1] A UK government project for predicting the future.

DOCUMENT 2

Prediction Failure

Cosmologists have much to look forward to: the direct detection of dark matter and gravitational waves, the extraction of more secrets of the early universe, the discovery of the cosmic neutrino background, possibly an exploding black hole, understanding dark energy, decisive evidence for or against the existence of the dimensions of space, new forces of nature and the possibility of time travel; perhaps even nano-sized space probes. I could go on.

All this is exciting, but take a moment to think back 50 years and look forwards. None of the greatest discoveries in the astronomical sciences were foreseen. The transformation in the practice of science brought along by the web is barely 30 years old. No one predicted it. Pulsars, quasars, gamma-ray bursts, the standard model of particle physics, the isotropy of the microwave background, strings and dark energy were equally unexpected. None of these was predicted 50 years ago.

Perhaps scientists are as blinkered as the politicians who failed to foresee the fall of the Iron Curtain and the climactic implications of industrialisation. Yet this myopia[2] may not be at fault. If you can foresee what is going to happen in your field over the next 50 years then maybe you will fail to attract the brightest minds as there is no need to do the discovering. Nothing truly revolutionary or ground breaking is ever predicted because that is what makes it revolutionary or ground-breaking.

John D. Barrow

[2] Short-sightedness, lack of ability to see forward

DOCUMENT 3

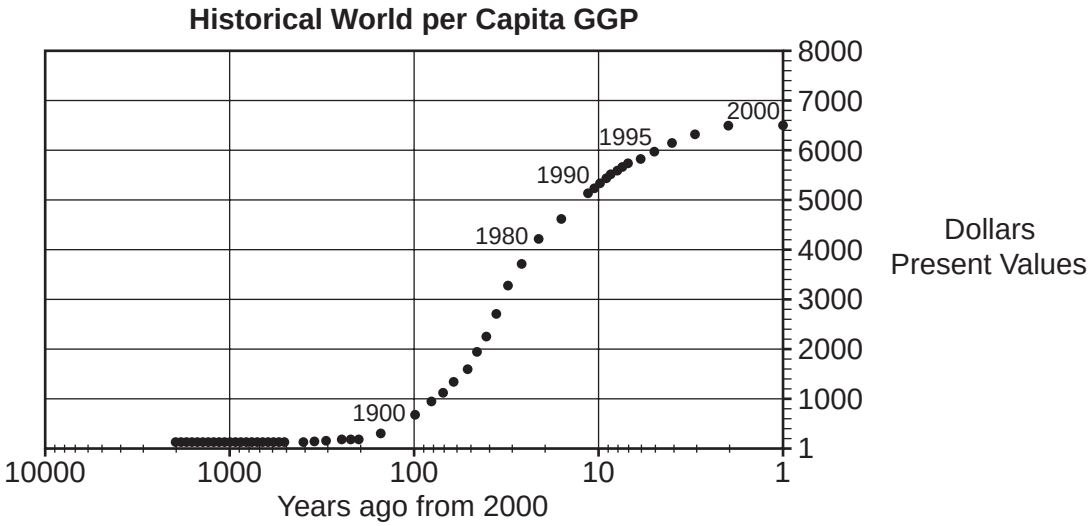
GGP as never before?

It never ceases to amaze me how so few people truly understand that there will be no poverty in the future. This is because of the growth in the world economy as a whole and the greater than average economic growth in poorer countries.

The world is progressing at an exponential[3] and accelerating rate. This is the most critical and fundamental aspect of making any attempt to understand and predict the future. Without a deep appreciation of this, no predictions of the intermediate and distant future are credible.

One dimension of accelerating, exponential progress can be seen in the economy. Today, the US economy grows at a median rate of 3.5% per year, and the world economy at around 4.5% per year. This is a growth rate that we have come to take for granted and expect.

But such annual growth rates were unheard of in the 19th century or the 18th century (when the world economy grew less than 1% per year). Things changed very little over the span of 10 or 20 years. People expected their children to have the same living standards, and be surrounded by the same technology as they were. Let us look at a graph of per-capita GGP (Gross Global Product), when viewed from the year 2000, looking backwards.



The rate of economic growth is apparent from the chart. Thousands of years of human civilization before the 20th century produced modest wealth compared to what was produced in the much shorter interval of the 20th century. Now, in 2006, 4% a year is assumed, and taken for granted. In fact, 3 billion people in the world are living in economies growing at greater than 6% a year (China, India, Russia, Vietnam, Pakistan, Thailand, Malaysia, and others).

This would have been considered amazing, at any other time in history. But is this just an aberration, or has the trend line itself shifted into higher gear, and can we expect this to continue, or even accelerate, in the future? My method predicts that the GGP in 2050 will be 6 times what it was in 2000. Technological innovations will drastically minimise the costs of health care, education, transportation, energy and entertainment. This will allow the poorest nations to rapidly climb up the ladder of prosperity. If we project even further (perhaps year 3050?!) into the future, the exponential curve will be so steep and the wealth that awaits us so vast that perhaps even the grandest visions of science fiction might be quite economically feasible.

A Futurist

[3] Rapid increase in mathematical terms

DOCUMENT 4

Five minutes to Doomsday

'In a world that is in chaos, politically, socially and environmentally, how can the human race sustain another 100 years?' Stephen Hawking, the Cambridge cosmologist, asked on the Internet site Yahoo! last summer. An astonishing 25 000 browsers rushed to give him their answers – ranging from 'We won't' to 'Somehow we will', and proposing solutions from banning nuclear weapons and tackling global warming to escaping into space.

In January 2007, led by Professor Hawking, the scientists of the Royal Society in London moved the minute hand of its 'Doomsday Clock' to five minutes to midnight to reflect the increased dangers faced by the world. Scientists had devised the Doomsday Clock in 1947 as a way of expressing to the public the risk of nuclear devastation, following the use of the nuclear weapons that destroyed Hiroshima and Nagasaki at the end of the Second World War.

Said Professor Hawking: 'As we stand at the brink of a second nuclear age and a period of unprecedented climate change, scientists have a special responsibility, once again, to inform the public and to advise leaders about the perils that humanity faces. As scientists, we understand the dangers of nuclear weapons, and their devastating effects, and we are learning how human activities and technologies are affecting climate systems in ways that may forever change life on earth.'

The board of directors of the Bulletin of Atomic Scientists issued a statement which reflects their assessment about the world's future: 'As in past deliberations, we have examined other human-made threats to civilisation. We have concluded that the dangers posed by climate change are nearly as dire as those posed by nuclear weapons.'

The Independent (newspaper)

DOCUMENT 5

A Futurist Philosophy

Doing the impossible simply means doing something for the first time – to understand the world of t years' time, we have to embrace the notion of unlimited possibilities.

There is nothing more marvellous than seeing what everyone else has seen, but nobody else has understood – this is how organisations will get to the future first and create competitive space in a highly competitive world.

In today's world, there is no shortage of people who can do things right, rather the challenge is in knowing the right things to do. The purpose of what is called 'futures research' must be to determine the right things to do.

It is in our power to visualise our preferred future and to create it. To understand the future we must see it in terms of possible, probable and preferred futures that we can influence in varying degrees.

The future is not what it used to be – we must look far beyond normal commercial time horizons to understand the forces of change and their impact. Even our definitions of reality need to be reviewed.

Actions speak louder than words and we must translate theory into practice. The work we do must have valued outcomes.

CFS (Centre for Future Studies)

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