Candidate Identifier Number:_____

UCL Language Centre Academic English (In-Sessional) Course

Spring Term 2007 (Revised post-exam)

Listening Examination: Lecture *Time allowed 50 minutes*

MEASURING TME

Before the lecture begins you will have 10 minutes to read this document. During the lecture you should complete the questions according to the instructions given.
Where you are required to complete the gap, it is usually one word per gap (with 1 mark per correct answer). Occasionally, you may have to write a phrase, but this should be clear from the question.

After the lecture you will have 10 minutes to check through the answers.

Please note that no questions will be asked during the Introduction.

[The marks available for each question are in brackets, *for example* (2), at the right hand side of the page at the end of each question.]

INTRODUCTION

No questions

I LEAP YEARS AND LEAP SECONDS

Complete the gaps:

1. Leap years occur how often? Every _____ years. (1)

2. How long is the tropical year? Complete the figure: 365.2421 _ _ days (2)

3. When will the next leap year occur? _____ (1)

4. What happened at one minute, 59 seconds to midnight on 31 December 2005?
*Circle **one** answer:*

   a) A second was added
   b) A second was subtracted (1)

5. ***Complete the gaps***: "A leap second is an intercalary, one-second _____ that keeps _____ standards for time of day close to mean _____ time. Leap seconds are used to keep time standards synchronised with _____ calendars, the basis of which is astronomical." (4)

6. What does *intercalary* mean?
*Circle **one** answer:*

a) added
b) inserted
c) corrected
d) adjusted (1)

7. *Link **each** type of time on the left with its correct description on the right: →*

Broadcast time	measured time
Solar time	natural time

(1)

8. **SI** refers to a French system of calculation.
*Circle **one** answer:*

True **False** (1)

9. *Link **each** date on the left with its correct information on the right: →*

1750-1892	atomic clocks slowed down because of longer solar days
1961-1971	broadcast and SI seconds were the same length
1972 →	length of broadcast second =1/8640 of solar day

(3)

10. *Link **each** set of dates on the left with their correct information on the right: →*

1972-2005	a leap second was inserted 23 times
1999-2005	longest period without a leap second

(1)

11. ***Complete the gaps*** for the abbreviation **IERS**: International _____

Rotation and _____ systems. (2)

12. ***Spell*** the name of the on-line Encyclopaedia: W _ _ _ _ _ _ _ _. (1)

II ATOMIC CLOCKS

Complete the gaps:

13. Atomic clocks were invented in _____ (year)

in South West _____.(city) (2)

14. Atomic clocks work on the principle of :
*Circle **one** answer:*

a) counting the vibrations produced when microwaves are absorbed by caesium atoms

b) measuring the particles of time vibrating in caesium atoms in seconds

c) determining the speed of the resonance of caesium atoms (2)

15. Since 1967 how has the second been defined?
*Circle **the most accurate** answer:*

a) **Less than 900 million** cycles of radiation between two caesium atoms
b) **Less than 9000 million** cycles of radiation between two caesium atoms
c) **More than 900 million** cycles of radiation between two caesium atoms
d) **More than 9000 million** cycles of radiation between two caesium atoms (2)

16. According to scientists in 2000, atomic clocks were sufficiently accurate.
*Circle **one** answer:*

True **False** (1)

17. Which type of atomic clock was invented first?
*Circle **one** answer:*

Optical microwave (1)

18. The atomic clock that US scientists built in 2001 was made widely available.
*Circle **one** answer:*

True **False** (1)

19 How much more accurate than the American's optical clock was the British one?

_____ (2)

20. ***Name*** two of the most important uses for very accurate clocks.

i) _____

ii) _____ (2)

21. These board describers are examples of what kind of technology?

_____ (1)

22. How accurately can a remote position be determined using

a) a microwave atomic clock _____ (1)

b) an optical atomic clock _____ (1)

23. Why might Professor Gill's clock be of interest to the Chinese?
*Circle **one** answer:*

a) they want to set up a joint space project with Professor Gill

b) they want to land a spacecraft gently

c) they plan to send a spacecraft to an unknown part of the universe

d) a very accurate clock will facilitate precise landing (2)

24. NPL's optical clock will be widely used in the next couple of years.
*Circle **one** answer:*

True **False** (1)

25. A more accurate definition of the second may allow scientists to learn more about:
Name two examples:

i) _____

ii) _____ (2)

III CALENDARS

26. Complete the information about the Chinese New Year.

2005 Date: _____

2006 Date: _____ (2)

27. According to Fraser, how many calendars are widely used today?
***Circle** the nearest number.*

4 40 400 (1)

28. ***Circle*** the ***one*** calendar which was **not** mentioned by the lecturer:

Islamic Julian Buddhist Indian

Hebrew Gregorian Chinese (1)

29. *Match **each** unit on the left with the correct classification on the right.* →

Day	timekeeping
Hour	calendar (1)

30. All calendars exist in both written and spoken forms.
*Circle **one** answer:*

True **False** (1)

31. The Gregorian calendar reached its existing form:
*Circle **one** answer:*

a) around 1600 b) around 1500 (1)

32. ***Name*** one religious group that uses the Gregorian calendar for religious purposes.

_____ (1)

33. When is Easter? *Match the years on the left with the dates on the right*: →

2005	16 April
2006	27 March (1)

34. When do leap years occur?
*Circle **one** answer:*

a) when the actual year can be divided by 4 and 100

b) when the actual year can be divided by 4 but not 100

c) when the actual year can be divided by 4 and 400

d) when the actual year can be divided by 4 but not 400 (2)

35. Which of the following statements about the Gregorian calendar is **not** correct?
*Circle **one** answer:*

a) It is based on a cycle of 400 years

b) It accumulates an error of a day every 2-3 thousand years

c) Its calendar year is almost the same length as the topical year

d) It consists of exactly 365 days per calendar year (2)

36. *Complete the gaps*. The months in the Islamic calendar are either _____ or _____ days long. The Islamic year is _____ days long. (3)

Complete the gaps:
37. Muslims fast during Ramadan, which means they do not _____ or _____ during the daytime. (2)

*Circle **one** answer:*
38. The date of the end of Ramadan moves
a) forward **b) backwards** by 11 days each year. (1)

Complete the gap:
39. The number **1385** refers to _____. (1)

40. On which **two** of the following days should either Christians or Jews **not** work?
*Circle **two** answers only:*

Saturday Sunday Friday (2)

41. Which of the following has an intercalary month?
*Circle **one** answer:*

The Islamic Calendar The Chinese Calendar (1)

42. The Chinese Calendar is used for which **two** of the following:
*Circle **two** answers:*

a) traditional festivals

b) farming activities

c) official purposes (2)

43. Apart from 2006, name another another year of the dog?_____ (1)

CONCLUSION

43. *Match **each** field on the left with its correct example on the right.→*

Philosophy	time as a line or as a circle
Psychology	time speeding up as we get older
Anthropology	saving or wasting time (3)

This is the end of the listening examination **Total 69 marks**

Candidate Identifier Number:_____ ***ANSWERS***Post marking

UCL Language Centre Academic English (In-Sessional) Course

Spring Term 2007

Listening Examination: Lecture *Time allowed 50 minutes*

MEASURING TME

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After the lecture you will have 10 minutes to check through the answers.

Please note that no questions will be asked during the Introduction.

[The marks available for each question are in brackets, *for example* (2), at the right hand side of the page at the end of each question.]

INTRODUCTION

No questions

I LEAP YEARS AND LEAP SECONDS

Complete the gaps:

1. Leap years occur how often? Every **4** years. (1)

2. How long is the tropical year? Complete the figure: 365.2421 **9 0** days (2)

3. When will the next leap year occur? **2008** (1)

4. What happened at one minute, 59 seconds to midnight on 31 December 2005?
*Circle **one** answer:*

   a) A second was added
   b) A second was subtracted (1)

(4)

5. ***Complete the gaps***: "A leap second is an intercalary, one-second **adjustment** that keeps **broadcast** standards for time of day close to mean **solar** time. Leap seconds are used to keep time standards synchronised with **civil** calendars, the basis of which is astronomical." (4)

6. What does *intercalary* mean?
*Circle **one** answer:*

a) added
b) inserted
c) corrected
d) adjusted (1)

7. *Link **each** type of time on the left with its correct description on the right: →*

Broadcast time _____ measured time

Solar time _____ natural time (1)

8. **SI** refers to a French system of calculation.
*Circle **one** answer:*

True **False** (1)

9. *Link **each** date on the left with its correct information on the right: →*

1750-1892 **atomic clocks slowed down because of longer solar days**

1961-1971 *broadcast and SI seconds were the same length*

1972 → length of broadcast second =1/8640 of solar day (3)

10. *Link **each** set of dates on the left with their correct information on the right: →*

1972-2005 _____ a leap second was inserted 23 times

1999-2005 _____ longest period without a leap second (1) **(11)**

11. ***Complete the gaps*** for the abbreviation **IERS**: International **Earth**

Rotation and **Reference** systems. *(no need to be upper case)* (2)

12. ***Spell*** the name of the on-line Encyclopaedia: W **i k e p e d i a** (1)

II ATOMIC CLOCKS

Complete the gaps:

13. Atomic clocks were invented in **1955** (year)

in South West **London** (city) (2)

14. Atomic clocks work on the principle of :
*Circle **one** answer:*

a) **counting the vibrations produced when microwaves are absorbed by caesium atoms**

b) measuring the particles of time vibrating in caesium atoms in seconds

c) determining the speed of the resonance of caesium atoms (2)

15. Since 1967 how has the second been defined?
*Circle **the most accurate** answer:*

a) **Less than 900 million** cycles of radiation between two caesium atoms
b) **Less than 9000 million** cycles of radiation between two caesium atoms
c) **More than 900 million** cycles of radiation between two caesium atoms
d) **More than 9000 million** cycles of radiation between two caesium atoms (2)

16. According to scientists in 2000, atomic clocks were sufficiently accurate.
*Circle **one** answer:*

True **False** (1)

17. Which type of atomic clock was invented first?
*Circle **one** answer:*

Optical microwave (1)
(11)

18. The atomic clock that US scientists built in 2001 was made widely available.
*Circle **one** answer:*

True **False** (1)

19 How much more accurate than the American's optical clock was the British one?

Three times (3x) (2)

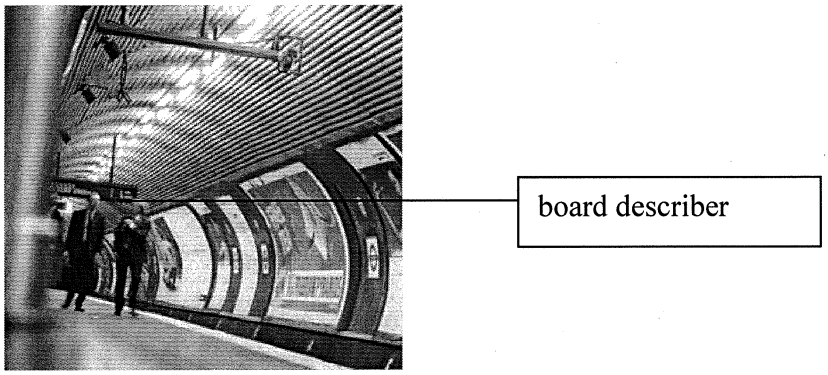
20. ***Name*** two of the most important uses for very accurate clocks.

i) **Navigation**

ii) **Global positioning** (2)

21. These board describers are examples of what kind of technology?

GPS (technology)/global positioning satellite (yechnology (1)



22. How accurately can a remote position be determined using

a) a microwave atomic clock **several metres** (1)

b) an optical atomic clock **centimetres** (1)

(8)

23. Why might Professor Gill's clock be of interest to the Chinese?
*Circle **one** answer:*

a) they want to set up a joint space project with Professor Gill

b) they want to land a spacecraft gently

c) <u>they plan to send a spacecraft to an unknown part of the universe</u>

d) a very accurate clock will facilitate precise landing (2)

24. NPL's optical clock will be widely used in the next couple of years.
*Circle **one** answer:*

True **<u>False</u>** (1)

25. A more accurate definition of the second may allow scientists to learn more about:
Name two examples:

i) **<u>Accept any 2 of the following: (laws of) physics; constant numbers; Analysing (laws of) physics;Newton's Law of gravity; gravity; the universe or outer space;</u>**
<u>improve tools used in daily life such as GPS = 0</u> (2)

III CALENDARS

26. Complete the information about the Chinese New Year.

2005 Date: **<u>Feb 9</u>**

2006 Date: **<u>Jan 29</u>** (2)

27. According to Fraser, how many calendars are widely used today?
***Circle** the nearest number.*

4 **<u>40</u>** 400 (1)
(8)

28. ***Circle*** the ***one*** calendar which was **not** mentioned by the lecturer:

Islamic Julian **Buddhist** Indian

Hebrew Gregorian Chinese (1)

29. *Match **each** unit on the left with the correct classification on the right.* →

Day	timekeeping
Hour	**calendar**

(1)

30. All calendars exist in both written and spoken forms.
*Circle **one** answer:*

True **False** (1)

31. The Gregorian calendar reached its existing form:
*Circle **one** answer:*

a) **around 1600** b) around 1500 (1)

32. ***Name*** one religious group that uses the Gregorian calendar for religious purposes.

Roman Catholic / Protestant =1/Catholic=1 (Christian = ½) (1)

33. When is Easter? *Match the years on the left with the dates on the right*: →

2005	**16 April**
2006	27 March

(1)
(6)

34. When do leap years occur?
*Circle **one** answer:*

a) when the actual year can be divided by 4 and 100

b) when the actual year can be divided by 4 but not 100

c) <u>when the actual year can be divided by 4 and 400</u>

d) when the actual year can be divided by 4 but not 400 (2)

35. Which of the following statements about the Gregorian calendar is **<u>not</u>** correct?
*Circle **one** answer:*

a) It is based on a cycle of 400 years

b) It accumulates an error of a day every 2-3 thousand years

c) Its calendar year is almost the same length as the topical year

d) <u>It consists of exactly 365 days per calendar year</u> **<u>(2)</u>**

36. *Complete the gaps*. The months in the Islamic calendar are either **<u>30</u>** or **<u>29</u>** days long. The Islamic year is **<u>354</u>** days long. (3)

Complete the gaps:

37. Muslims fast during Ramadan, which means they do not **<u>eat</u>** or **<u>Drink (allow smoke in either gap)</u>** during the daytime. (2)

*Circle **one** answer:*

38. The date of the end of Ramadan moves

a) forward **<u>b) backwards</u>** by 11 days each year. (1)

Complete the gap:

39. The number **1385** refers to **<u>this year /2007</u>** (1)

(11)

40. On which **two** of the following days should either Christians or Jews **not** work?
*Circle **two** answers only:*

Saturday **Sunday** Friday (2)

41. Which of the following has an intercalary month?
*Circle **one** answer:*

The Islamic Calendar **The Chinese Calendar** (1)

42. The Chinese Calendar is used for which **two** of the following:
*Circle **two** answers:*

a) **traditional festivals**

b) **farming activities**

c) official purposes (2)

43. Apart from 2006, name another year of the dog?_ **1958/70//82/94/2018** (1)

CONCLUSION

43. *Match **each** field on the left with its correct example on the right.→*

Philosophy	*time as a line or as a circle*
Psychology	**time speeding up as we get older**
Anthropology	saving or wasting time

(3)

(9)

This is the end of the listening examination **Total 69 marks**

There will be no questions in the introduction

MEASURING TIME

INTRODUCTION

Good afternoon everyone. What time is it? Well, according to my watch its….. and that clock says ……How accurate are these times and how can I check the real time? What is a second and how long is it? Has it always been the same length? What about a leap year? Do you know what that is and how often it occurs? We all know that today is 23rd March, 2007 but according to which calendar? Is it solar or lunar and what's the difference? How many calendars are currently in use worldwide? Is it 4, 40 or 400? Well, as you might now have guessed, the topic of this lecture is measuring time and in it I will try to answer all these questions. I've divided my talk into 3 sections. After this introduction, I'll be talking about..

I LEAP YEARS AND LEAP SECONDS

I'd like to start with Leap years. When was the last leap year? How often do they occur? Why do they occur? Well, as you probably know, once every four years (in a leap year), an extra day is added to the end of February so that it has 29 days instead of the usual 28 days. The purpose of this is to ensure that the calendar we now all use is synchronised with the seasons. Since the tropical year (or the year that most accurately reflects the seasons) is 365.242190 days long, a leap year must be added roughly once every four years to readjust the calendar to the seasons. The last leap year was in 2004, so the next one will be in ....?

Now, I'm fairly sure that you all know about leap years (even if you didn't know the exact word in English before this lecture) but do any of you know about leap seconds?

Well, at the beginning of 2006, something unusual happened to our time – a second was added. So at 23:59:59 (eleven o'clock, 59 minutes and 59 seconds) on New Year's eve

2005, it suddenly became 12.00 (twelve o'clock) and 2006. Were you late in wishing your friends "Happy New Year"? How many of you even knew about that? According to Wikepedia, (and I quote) "a leap second is an intercalary, one-second adjustment that keeps broadcast standards for time of day close to mean solar time. Leap seconds are used to keep time standards synchronized with civil calendars, the basis of which is astronomical."

I'd like to explain this in a little more detail!

First of all a leap second is inserted (this is what *intercalary* means) at a time when it causes least inconvenience such as around midnight at New Year but leap seconds have also been inserted at the end of June 30th. Broadcast time refers to the correct time we get from external sources for example the radio and now GPS (Global Positioning Systems – I'll explain these in a little more detail later). Solar time, as the name implies, refers to time calculated according to the sun, so solar time is based on the idea that when the sun reaches its highest point in the sky, it is noon.

Leap seconds are necessary because broadcast time is now measured utilizing stable atomic clocks. The atomic clock refers to its seconds as SI seconds. (To digress, SI refers to the International System of Units and is abbreviated to SI from the French language name *Système International d'Unités.* SI units in all fields are the most widely used system of units both in everyday commerce and in science.)

To return to the SI second, how long is an SI second? It is counted by atomic time standards and has been defined in such a way that its length matched the traditional second. The traditional second had been defined as 1/86400 (*one over 8 6 4 0 0*) of a mean solar day between 1750 and 1892. Since that time, however, the length of the solar day has been slowly increasing because the rotation of the Earth has been slowing down. The solar day has gradually become 1.7 milleseconds (or thousandths of a second) longer every century.

Therefore the time as measured by the rotation of the Earth has been accumulating a delay with respect to atomic time standards. From 1961 to 1971 the rate of atomic clocks was constantly slowed down in order to stay in sync with the rotation of the earth. From 1972 onwards, broadcast seconds have been exactly equal to the length of the SI second, which was chosen in 1967 as a certain number of atomic vibrations. (I will talk about atomic clocks in a little more detail later.)

So, leap seconds have become necessary to counteract the effect of the slowing down of the earth's rotation. Historically, leap seconds have been inserted about every 18 months. However, the Earth's rotation rate is unpredictable in the long term, so it is not possible to predict the need for them more than six months in advance. Between January 1972 and December 2005, a leap second was inserted on 23 occasions. The interval between 1st January 1999 and 31st December 2005 was the longest period without a leap second since the system was introduced. The IERS, which is the International Earth Rotation and Reference Systems Service, is the body responsible for maintaining global time . Among its other functions, the IERS is responsible for announcing leap seconds.

If you look at the diagram (from the free, on-line encyclopaedia called Wikepedia – that's W – i – k – e – p – e – d – i – a -) we can see how often and when leap seconds have been inserted in the last 20 years.

II ATOMIC CLOCKS

As these leap seconds are calculated according to atomic clocks, I would now to talk a little about atomic clocks. These were invented in 1955 at the National Physical Laboratory in Teddington (or NPL), South West London. Atomic clocks (picture) are extremely accurate. The accurate definition of time has long been important for everything from the movement of information over the Internet, including billions of pounds of financial transactions, to distributing electricity. The length of a second, wherever it is officially used, is currently defined using atomic clocks.

Why are they called atomic and how do they work? Well, they detect and measure the amount of absorption of microwaves by atoms of caesium. This absorption produces a regular resonance, or kind of vibration; the number of these vibrations is then used to define minute *(my-newt)* particles of time such as seconds. The early atomic clocks were known as microwave atomic clocks (Picture)

Since its invention in 1955, the accuracy of this clock has continued to be developed. By 1967, it had become the basis for the definition of the second as the duration of 9,192,631,770 *(nine thousand, one hundred and ninety two million, six hundred and thirty one thousand, seven hundred and seventy)* cycles of the radiation between two energy levels of the Caesium-133 *(one three three)* atom. By 2000, the best atomic clocks were so accurate they only lost one billionth of a second a day. I wonder how much time your watch loses or gains per day? However, despite this degree of accuracy, scientists were still not satisfied – they wanted to reduce even that one billionth of a second loss. But as with all attempts to improve on something that is already very good, it becomes harder and harder to make any real progress. (As an aside, very advanced students of English have to make very great efforts, much greater than many of you here, to make any perceptible, or noticeable improvement in their English.)

To return to my atomic clocks, scientists nevertheless did try to make their microwave atomic clocks more accurate. They did this by using optical frequencies that are higher (and therefore faster) than those of the microwaves I mentioned earlier. In 2001 US scientists built a protoype optical atomic clock that "ticked" (the action a clock makes as it moves through time) at more than a million billion times a second. (By the way, "prototype" means an initial and usually experimental model of something.) But in November 2004, the Guardian proudly reported a headline "Britons invent the world's most accurate clock". Professor Gill of the NPL modified the American scientists' optical clock and produced a clock three times more accurate than the American one.

By this time, you are probably wondering why we really need such accurate clocks. Well, according to Professor Gill (and I quote), "The most significant technology application is

in navigation and global positioning". (I assume most of you know what global positioning systems or GPS is: it is a system that makes it possible to define the exact location an on object. Examples from our daily life are the boards announcing the number of minutes to the next tube at the tube station or bus at the bus stop (picture of dot matrix)). Professor Gill goes on to say that at present, most satellites (pictures) which are essential for global positioning use the original microwave clocks which are referenced to master clocks on the ground. This enables position to be determined to about several metres accuracy. With an optical clock, this could come down to centimetres and it would mean more accurate readings for moving objects, such as a car. And of course, Professor Gill's new optical clock would be even more effective than the American's optical clock. Another use of the new technology would be deep space exploration – a topic which I know is of great interest at present to the Chinese. (Picture of Chinese spacecraft) Professor Gill says: "If you are sending a spacecraft millions of kilometres to an unknown part of the universe, and asking it to land gently in a particular place, then we need a pretty accurate clock to synchronise its navigation equipment."

Additionally, if NPL's optical clock is accepted as the new method for defining a second, it could also provide a tool for analysing the most fundamental laws of physics. This might even include the constant numbers used in the calculation of Newton's law of gravity. So, a more accurate definition of the second may allow scientists to learn more about the universe – here and in outer space, as well as improve tools used in our daily life such as GPS.

III CALENDARS

Now, I'd like to move away from talking about seconds to looking at whole months and years and to take a more cultural approach to time: calendars. When is New Year? 1 Jan? Is it the same day each year? What about the Chinese or the Persian New Year? I know that last year (2006 *omit when reading*) the Chinese New Year was on 29 January whereas the year before (2005 *omit when reading*) it was on February 9th . That's a difference of 11 days. How are years and the number of days in a year calculated? Well,

it has been estimated (Fraser 1987) that there are about 40 calendars in use in the world today although only about half a dozen are widely used. These are: the Gregorian, the Hebrew, the Islamic, the Indian, the Chinese and the Julian.

A calendar can be defined as a system of organizing units of time for the purpose of calculating time over extended periods. By convention, the day is the smallest calendrical unit of time; the measurement of fractions of a day is classified as timekeeping. Although some calendars follow astronomical cycles according to fixed rules, others are based on abstract, constantly repeating cycles with have no astronomical significance. Some calendars are codified in written laws; others are transmitted by oral tradition.

To be more specific, I'd now like to describe the main features of three of the more common calendars – features that some of you will no doubt be familiar with. These calendars are the Gregorian, the Islamic and the Chinese.

To start with, I'd like to mention the Gregorian calendar.(picture) This was finalised, after a number of revisions under Pope Gregory in Rome on February 24, 1582. This calendar today serves as an international standard for everyday and commercial use. In addition, it regulates the ceremonial cycle of the Roman Catholic and Protestant Christian churches. In fact, its original purpose was ecclesiastical, that is to regulate the days for religious festivals, especially Easter, which is still a moveable feast – celebrated on a different day each year in either March or April. Last year (2006 *omit when reading)* it was on 16 April whereas the year before (2005 *omit when reading)* it was on 27 March – a difference of 20 days or nearly three weeks.

Years and are divided into two classes: common years and leap years. A common year is 365 days in length; a leap year is 366 days, with an intercalary day, designated February 29, preceding March 1 (remember that 'intercalary' means inserted). Leap years are determined according to the following rule: Every year that is exactly divisible by 4 is a leap year, except for years that are exactly divisible by 100; these centurial years are leap

years only if they are exactly divisible by 400. As a result the year 2000 is a leap year, whereas 1900 and 2100 *(twentyone hundred)* are not leap years.

The Gregorian calendar is thus based on a cycle of 400 years, which comprises 146,097 days. Since 146,097 is evenly divisible by 7, the Gregorian civil calendar exactly repeats after 400 years. Dividing 146,097 by 400 yields an average length of 365.2425 days per calendar year, which is a close approximation to the length of the tropical year, based on the sun, as I mentioned earlier. The Gregorian calendar accumulates an error of one day in about 2500 years. Although various adjustments to the leap-year system have been proposed, none has been instituted.

The next calendar I would like to mention is the Islamic calendar.(picture) The Islamic calendar is a purely lunar calendar (that is, based on the moon) in which months correspond to the lunar phase cycle. There are 12 lunar months of alternately 30 and 29 days, making the year 354 days long. Because of the shortness of the year, the months move backward through all the seasons, completing a cycle every 32 1/2 *(thirty two and a half)* years. There are no intercalary, or leap months. The result of this is that the holy month of Ramadan, when Muslims fast during daylight hours (that is, they do not eat, drink, or smoke) occurs in different seasons in different years. The end of Ramadan in 2005 was 4 November and last year (2006) it was 24 October and – a difference of 11 days. In 2007 it will be 11 days earlier again. The years are counted from the year of the flight in AD622 of Muhammad from Mecca to Medina in present-day Saudi Arabia. So AD622 became year 1 in the Muslim calendar. This year is therefore 1385 *(thirteen eighty five)* (or 2007 minus 622).

The seven-day week is observed with each day beginning at sunset. Weekdays are specified by number, with day 1 beginning at sunset on Saturday and ending at sunset on Sunday. Day 6, which is called Jum'a, is the day for congregational prayers. Unlike the Sabbath days of the Christians and Jews (Sunday and Saturday respectively), however, Jum'a is not a day of rest. Jum'a begins at sunset on Thursday and ends at sunset on Friday.

The final calendar I'd like to mention is the Chinese calendar. (picture) The beginnings of the Chinese calendar can be traced back to the 14th century BC (or Before the Common Era). The Chinese calendar is a luni-solar calendar based on calculations of the positions of the sun and moon. Months of 29 or 30 days begin on days of astronomical New Moons, with an intercalary month being added every two or three years. Since the calendar is based on the true or measured positions of the Sun and Moon, the accuracy of the calendar depends on the accuracy of the astronomical theories and calculations.

Although the Gregorian calendar is used in the Peoples' Republic of China for administrative purposes, the traditional Chinese calendar is used for setting traditional festivals and for timing agricultural activities in the countryside. The Chinese calendar is also used by Chinese communities around the world. One of the interesting features of the Chinese calendar is the way in which the years are grouped in cycles of 12 years – each of which is represented by an animal. I was born in the year of the tiger which was 1950, 1962, 1974, 1986. I'll leave you to work out exactly which one! Last year was the year of the dog and this year, as I'm sure most of you know, is the year of the pig.

CONCLUSION

So, to sum up, I've talked about different methods of measuring time and I've looked at some cultural differences in relation to three different calendars in use today. I have tried to indicate the significance of how we measure time: first in terms of our daily life; then in relation to scientific developments including space exploration; and finally time as it affects religion and religious observance. Of course, I have omitted many aspects of time from this lecture: the philosophical where I might have talked about such concepts as saving and wasting time; the psychological where I could have touched on why time seems to pass so slowly when we are children but increasingly speeds up as we get older; I also didn't mention anthropological ideas of time by examining how some cultures perceive time as linear and others as cyclical. Such subjects are fascinating but they are the subject of another lecture. Thank you for listening.