**The 1st International Olympiad on Astronomy and Astrophysics**

**Chiang Mai, Thailand**

**Experimental Competition (Data Analysis)**

# Monday, 3 December, 2007

**Please read this first:**

1. The time available is 3 hours for the experimental competition (Data analysis). There are three questions (and a set of data table).
2. Use only the pen provided.
3. Use only the front side of ***writing sheets***. Write only inside the boxed area.
4. Begin each question on a separate sheet.
5. For each question, in addition to the ***blank writing sheets***, there are the ***Answer Sheets*** where you *must* summarize the results you have obtained. Numerical results should be written with as many digits as are appropriate.
6. Write on the blank ***writing sheets*** whatever you consider is required for the solution of the question. Please use *as little text as possible*; express yourself primarily in equations, numbers, figures, and plots.
7. Fill the boxes at the top of each sheet of paper with your country code, your student code, the question number, for each question the consecutive number of each sheet (Page Number), and the total number of ***writing sheets*** used**.** If you use some blank ***writing sheets*** for notes that you do not wish to be marked, put a large X across the entire sheet and do not include it in your numbering.
8. Students given questions, writing sheet and answer sheets in English and national language can answer in any one sheet but must return both to the marker (examiner).

9. At the end of the exam, arrange all sheets for each problem *in the following order:*
    - *Answer Sheet(s)*
    - used *writing sheets* in order
    - the sheets you do not wish to be marked
    - unused sheets and the printed question

    Place the papers inside the envelope and leave everything on your desk. You are not allowed to take *any* sheets of paper out of the room.

**Some useful information for calculation**

| | |
|---|---|
| Astronomical unit (A.U.) | 149,597,870 km |
| Mean distance, Earth to Moon | 384,399 km |
| Obliquity of the ecliptic | 23° 26' |
| Earth's mean radius | 6,371.0 km |
| Earth's mean velocity in orbit | 29.783 km/s |
| Sidereal year | 365.2564 days |
| Tropical year | 365.2422 days |
| Sidereal month | 27.3217 days |
| Synodic month | 29.5306 days |
| Mean sidereal day | 23h56m4s.091 of mean solar time |
| Mean solar day | 24h3m56s.555 of sidereal time |

**Question 3** **Solar System objects (8 points)**

A set of data containing the apparent positions of 4 Solar System objects over a period of 1 calendar year is given in Table 1. Show your method of data analysis carefully and answer the following questions.

| | | |
|---|---|---|
| Location of observer | Latitude : | N 18° 47’ 00.0” |
| | Longitude : | E 98° 59’ 00.0” |

3.1 Put the letters A, B, C and D beside the appropriate objects on the answer sheet. **(2 points)**

3.2 During the period of observation, which object could be observed for the longest duration at night time? **(1 point)**

3.3 What was the date corresponding to the situation in 3.2? **(1 point)**

3.4 Assuming the orbits are coplanar (lie on the same plane) and circular, indicate the positions of the four objects and the Earth on the date in 3.3, in the orbit diagram provided in your answer sheet. The answer (sheet) must show one of the objects as the Sun at the centre of the Solar System. Other objects including the Earth must be specified together with the correct values of elongation on that date. **(4 points)**

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