Reporting Assignment

In deriving or proving solutions do not skip the calculation process but describe it. You can use English or Japanese.

Problem 1

Answer the following problems on the two-body problem:

1. Derive the eccentricity vector and explain its meaning.
2. Express the eccentricity vector in terms of orbital elements (e, I, Ω, ω) and show it can be approximated by $(e\cos\varpi, e\sin\varpi)$ when I is small.

Problem 2

Answer one of the following two problems on the three-body problem:

1. Answer the following problems on the circular restricted three-body problem:
   (a) Derive the Jacobi integral.
   (b) Obtain the condition for Lagrange points.
   (c) Obtain the triangular solutions and show their stability.
2. Answer the following problems on the Hill problem:
   (a) Derive the Hill equation.
   (b) Obtain the analytical solution of the Hill problem when the gravitational interaction between two bodies is neglected.
   (c) Calculate the Hill radius in radial and azimuthal directions.

Problem 3

Answer the following problems on the motion of a satellite around an oblate planet.

1. Derive the disturbing function of order up to J_2.
2. Calculate the secular term of the disturbing function by orbit averaging.
3. Discuss the secular evolution of the satellite orbit.

Problem 4

Answer the following problems on the Kozai mechanism:

1. Derive the disturbing function for planetary perturbation of order up to $(r/r')^2$ using the lunar theory.
2. In the secular evolution of the asteroid orbit perturbed by Jupiter there are two conservative quantities. Describe them.
3. Obtain the maximum eccentricity excited by the Kozai mechanism (ω-libration) as a function of the initial inclination.

Problem 5

Discuss freely what you are interested in or you like to know more in celestial mechanics.

Submission

Submit your report by 17:00 on August 7th by one of the following ways:

- e-mail: send a PDF file to Ms. Mashiko (secretaries@cfca.nao.ac.jp) with subject "CMV19 REPORT". Please confirm the submission confirmation e-mail that she sends you back.

- paper: submit a report to the office of the department of astronomy on the 11th floor of the faculty of science building 1.