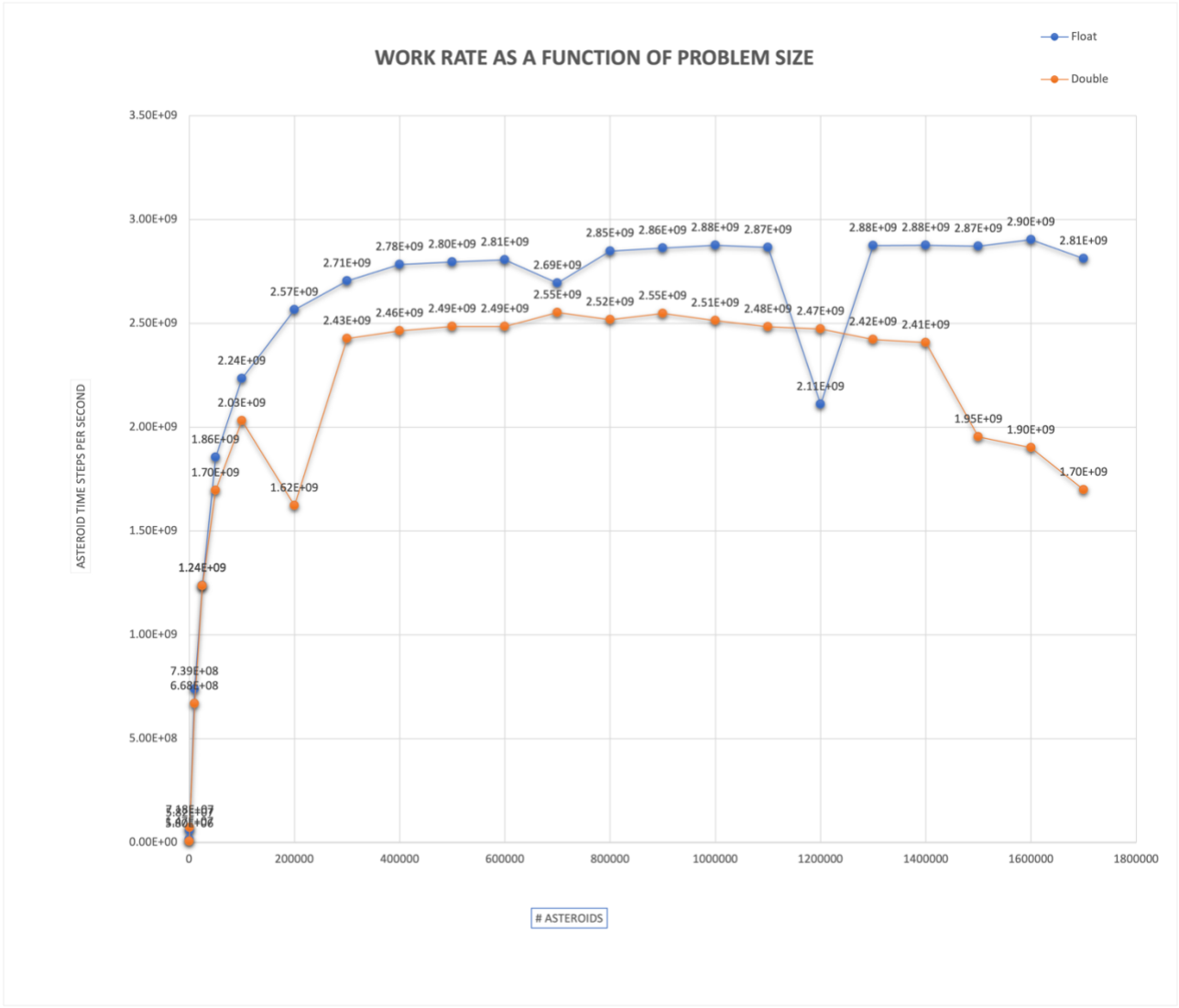
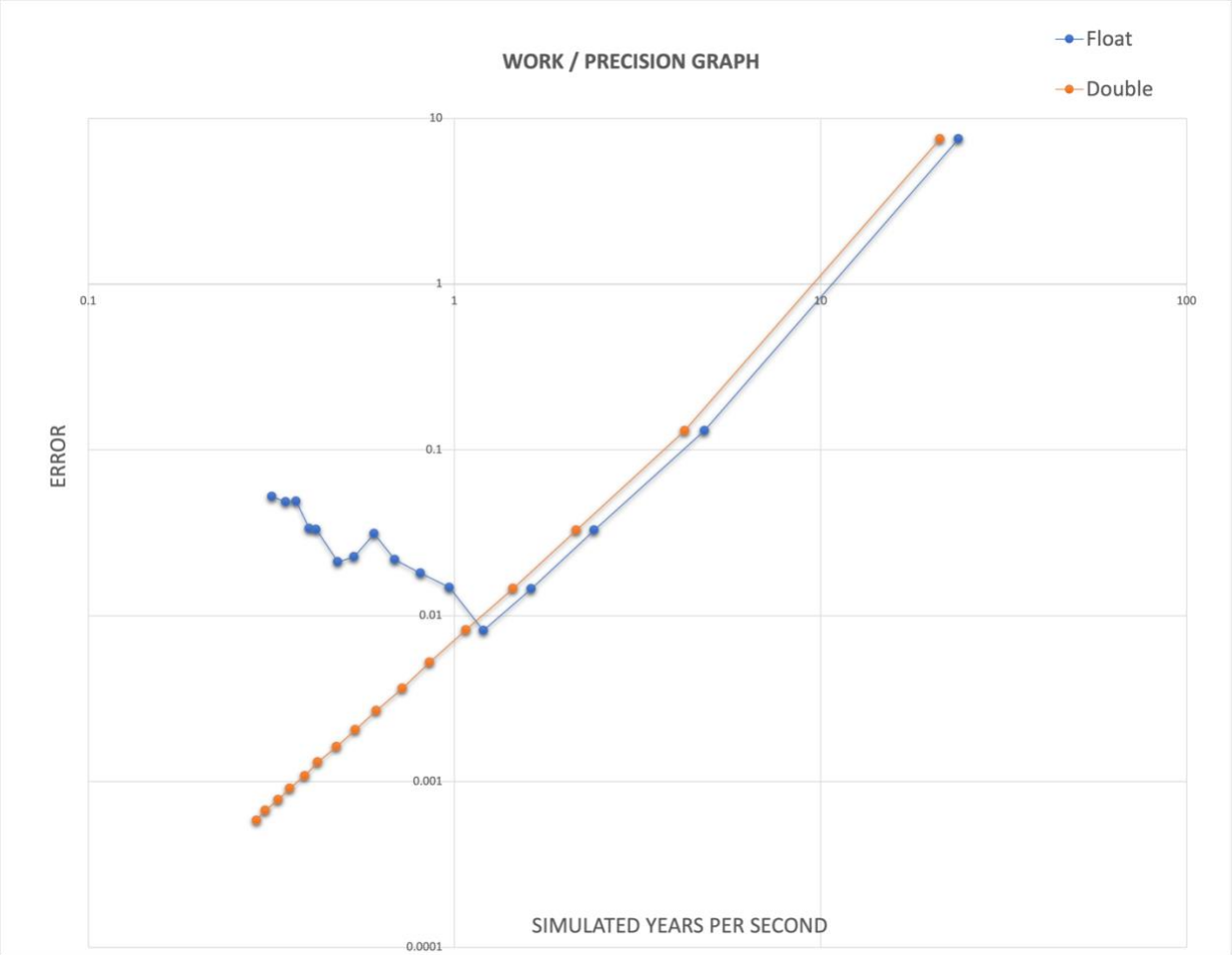
HPPC Assignment 2
Orbiting Asteroid Simulation

Adarsh Kumar Sadhukha
903616270
asadhukha@gatech.edu

Step 4: Work Rate as Function of Problem Size



Step 5: Work / Precision Diagram



Step 6: Q & A

Question 1: For each of float and double, find the largest value of asteroid time steps per second in figure 1, and determine what percentage of the peak Tflop/s of the node it achieves. (To figure this out, you will have to determine how many flops are in an asteroid time step. Estimate this by looking at the code in the timestep() function, which is where almost all of the time is spent.)

Answer 1:

Float:

Max(Asteroid Time Steps per second): 2.90E+09
Flops per Time Step: 19
System Max(TFlops/s whole node) = 2.8E+12
% peak Tflop/s = (2.90E+09 * 19 * 100) / 2.8E+12 = **1.97%**

Double:

Max(Asteroid Time Steps per second): 2.55E+09
Flops per Time Step: 19

System Max(TFlops/s whole node) = 1.5E+12
% peak Tflop/s = (2.55E+09 * 19 * 100) / 1.5E+12 = **3.23%**

Question 2: For each of float and double, look at the asteroid time steps per second of the largest number of asteroids you simulate and estimate what percentage of the peak Gbyte/s of bandwidth from main memory it achieves. (To figure this out, you will have to determine the number of bytes read and written in each asteroid time step.)

Answer 2:

Float:

Bytes read/written per Time Step: 4 * 14 = 56 bytes
Asteroid Time Steps per second$_{\text{max \#asteroids}}$ = 2.81E+09
Max Bandwidth$_{\text{whole node}}$ = 200 Gbyte/s
% peak bandwidth achieved = (2.81E+09 * 56 * 100) / 200E+09 = **78.68%**

Double:

Bytes read/written per Time Step: 4 * 14 = 96 bytes
Asteroid Time Steps per second$_{\text{max \#asteroids}}$ = 1.70E+09
Max Bandwidth$_{\text{whole node}}$ = 200 Gbyte/s
% peak bandwidth achieved = (1.70E+09 * 96 * 100) / 200E+09 = **81.6%**

Question 3: Look at figure 2 and give guidance to someone who want to use your simulation about when they should use single precision or double precision arithmetic.

Answer 3:

Case 1: Simulated Years per Second > 1: **Use Single Precision numbers for minimizing error**.

Case 2: Simulated Years per Second <= 1: **Use Double Precision numbers for minimizing error**.