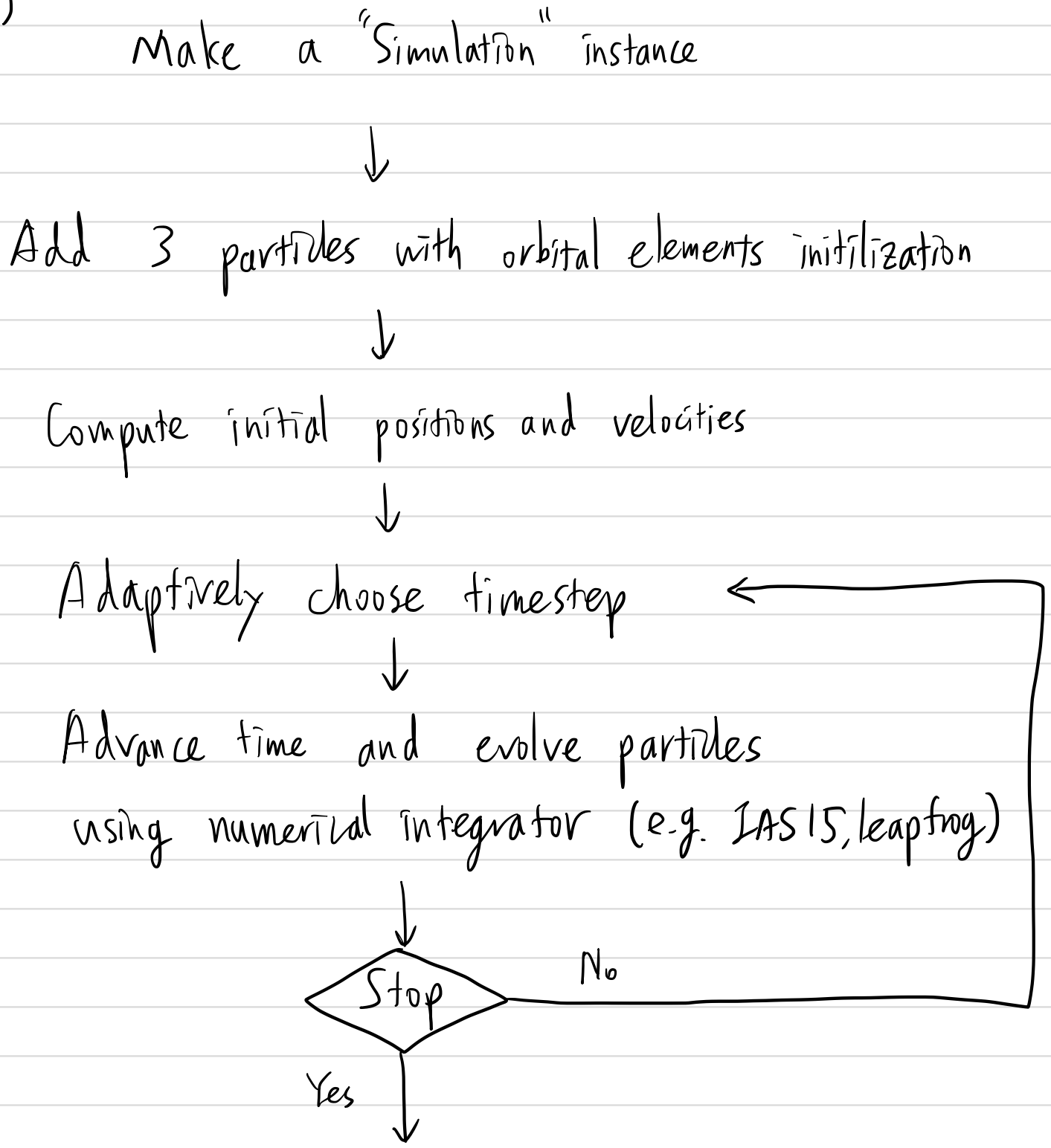
HW3 Joohyun Lee

1. a)



b) Name	order of accuracy	suitable problem	tunable parameters
IAS15	15	generic force problem, close encounter	minimum timestep
WHFAST	2	Keplerian system with perturbations	symplectic correctors timestep
Bragg-Bulirsch-Stoer		shore integrations	error at each timestep minimum/maximum timestep
SABA	varies (tunable) default: 4		order of accuracy
JANUS	default: 6		order of accuracy length/velocity scale
Embedded Operator Splitting	varies (tunable)		order of accuracy
Leapfrog	2		
Symplectic Epicycle Integrator	2		epicyclic/orbital frequency

c) (1) Leapfrog

read particle data

↓

Part 1 — Compute new position (parallelized)

$$\vec{r} = \vec{r_0} + \vec{v}\frac{1}{2}\delta t$$

↓

advance time by $\frac{1}{2}\delta t$

read particle data

↓

Part 2 — Compute new velocity (parallelized)

$$\vec{v} = \vec{v_0} + \vec{a}\frac{1}{2}\delta t$$

↓

Compute new position (parallelized)

$$\vec{r} = \vec{r_0} + \vec{v}\frac{1}{2}\delta t$$

↓

advance time by $\frac{1}{2}\delta t$

(2) SEI

Initialize — get epicyclic/orbit rotation angle

Integrator — advance vertical position/velocity

↓

advance orbital plane position/velocity

Pare1

Initialize

↓

advance each particle (parallelized)

using Integrator

Pare2

Initialize

↓

update each particle velocity (parallelized)

$\vec{v} = \vec{v}_0 + \vec{a}\,\delta t$

↓

advance each particle (parallelized)

using Integrator