Student's ***NetID***_____Student's Name_____Grader's Name_____
(netID == 3 letters, 3 digits: e.g. jet861 Please write clearly; make it easy to read)

Project A: Particle Systems **(46% of final grade)**
CS 351-2 Intermediate Computer Graphics **Spring 2018**

--Up to 85% of grade ---COMPULSORIES--- Your program MUST demonstrate:

_____5% **All file-naming correct + clear illustrated PDF report** with name, netID, title, goals, how to get on-screen help, user-guide, code guide, ≥5 half-page pictures, explains 'optionals' chosen below.

_____10% 3D interactive viewing: ability to aim stationary camera in any desired direction and then move in the camera-aiming direction, and 'strafe' perpendicular to aiming direction(e.g.'glass tube'). Easy, intuitive, unrestricted 3D.

_____8% Demonstrate all 3D particle systems run together at 'interactive' rates (~3 frames/second (FPS)).

_____12% Multiple constraints that prevent particles from passing through a set of surfaces, including at least: **a)** a visible 3D ground plane plus 4 or more enclosing walls, **b)** At least 2 other shapes that exclude all particles (e.g. sphere, cylinder, box…) to limit all particle movements in each of the four systems below:

_____10% **System 1:** 500 or more independent particles that move in response to at least one 3D position-dependent vector force-field defined in world coordinates & added to gravity: tornados, magnets, etc.

_____10% **System 2:** 90 or more 'flocking' or 'boids' particles that respond to nearby neighbors to form a unified moving group that exhibits: a) separation, b) cohesion, c) alignment, and d) evasion.

_____10% **System 3:** 600 or more particles that simulate continuously burning flame and fire-like behavior on-screen; each particle with a visible lifecycle that affects mass, color, trajectory and more.

_____12% **System 4:** 10 or more particles linked together by a set of 3D springs to form a stiff but elastic shape: a rope, a cloth-like surface, or a 3D solid shape that users can stretch, squeeze, drape and/or bounce onto some form of fixed constraints. (e.g. hang fa flag from a flagpole and push with a puff of 'air' (force field); a tetrahedron users can toss into the air to bounce off walls and floors; a rope that droops, stretches, snaps back.

_____8% **Demonstrate both stable & unstable Solvers:** solve a stiff, weakly-damped system of springs with an Explicit Euler solver to demonstrate instability, then switch solvers to show the exact same system is stable when solved by an implicit or semi-implicit solver.

--At Least 15% of grade ---OPTIONALS--- Your program MAY demonstrate:

_____3% each: multiple solver types—switching between them shows tradeoffs

_____Adams-Bashforth	____Explicit: Midpoint	_____ Velocity Verlet
_____Iterative Implicit:Euler	____Symplectic Euler	_____ Heun Method
_____Iterative Implicit:Midpoint	____Verlet	_____ Other (name it!)

_____3% each: additional constraint type (other than walls and ground plane) LIST THEM!
`

_____5% each: additional force-makers: charged particles, fluid flow (Navier-Stokes approx), user-switched attraction/repulsion to a shape; attract/repulse to current mouse cursor-controlled shape, MHD, etc.

_____5% each: novel rendering methods: sprites, streaks, textures, non-dot shapes; show springs, etc.

_____/100 TOTAL

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CS 351-2 Intermediate Computer Graphics **Spring 2017**

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_____10% 3D interactive viewing: demonstrate interactive camera positioning with user –controlled camera viewing direction AND viewing position (starter code is not enough!)

_____8% Demonstrated 3D particle systems all run at 'interactive' rates (>5 frames/second (FPS))?

_____12% Multiple constraints that prevent particles from passing through a set of surfaces, including at least: **a)** a visible 3D ground plane plus 4 or more enclosing walls, **b)** At least 2 other shapes that exclude all particles (e.g. sphere, cylinder, box…) to limit all particle movements in each of the four systems below:

_____10% **System 1:** 1,000 or more independent particles that move in response to at least one 3D position-dependent vector force-field defined in world coordinates & added to gravity: tornados, magnets, etc.

_____10% **System 2:** 90 or more 'flocking' or 'boids' particles that respond to nearby neighbors to form a unified moving group that exhibits: a) separation, b) cohesion, c) alignment, and d) evasion.

_____10% **System 3:** 1,000 or more particles that simulate continuously burning flame and fire-like behavior on-screen; each particle with a visible lifecycle that affects mass, color, trajectory and more.

_____12% **System 4:** 20 or more particles linked together by a set of 3D springs to form a stiff but elastic shape: a rope, a cloth-like surface, or a 3D solid shape that users can stretch, squeeze, drape and/or bounce onto some form of fixed constraints. (e.g. hang fa flag from a flagpole and push with a puff of 'air' (force field); a tetrahedron users can toss into the air to bounce off walls and floors; a rope that droops, stretches, snaps back.

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