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Project idea: capillary interaction between floating shapes
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As objects float on water, the surface of the liquid is distorted and either sticks or is repulsed from hydrophilic or hydrophobic objects with different possible angles of contact. Due to surface tension, this causes an attractive or repulsive capillary force between objects similar to an electrical interaction. The idea of this project would be to simulate this effect.
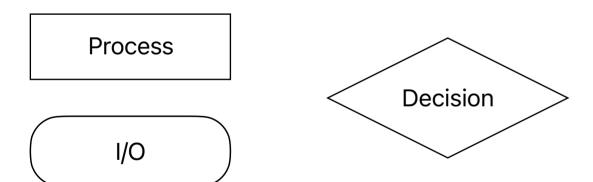
The program would contain three modules: grid, shapes and dynamics.

Grid would implement procedures to initialize a global water surface grid, write it to a file, and other global operations.

Shapes would implement different shape data types with defined coordinates, velocities, accelerations and geometric properties (e.g. radius), and procedures to model their physical interactions through the water surface.

Dynamics would contain an integrating procedure to calculate the shapes displacement through the grid.

Legend:

- Process
- I/O
- Decision

main program

- Initialize grid
- Get floating shapes from user
- Balance shapes individually on water surface
- Calculate forces, call integrator
- Write new positions
- Collision? — no → Time limit reached?
- Collision? — yes → End simulation
- Time limit reached? — no → Calculate forces, call integrator
- Time limit reached? — yes → End simulation

subroutine equilibrate

- Receive shape as argument
- Find hydrostatic balance: weight vs buoyancy
- Apply surface tension, displace object
- Calculate new buoyancy and surface tension
- Forces equilibrated? — no → Apply surface tension, displace object
- Forces equilibrated? — yes → End subroutine

subroutine forces

- Receive shapes as argument
- Calculate water level perturbations
- Integrate normal pressure over contact surface
- Update object attribute: acceleration
- End subroutine

do $i = 1, n$
do $j = i, n$
pairwise shape interaction

do $i = 1, n$
for each shape