

Worksheet 1: Memory Layout & Performance

Objective

Understand how data layout affects memory access patterns and performance.

Predict performance outcomes before measuring them.

Part A: Prediction

Study the two data layouts below. Predict which layout will perform better when iterating over the position values only.

```
#include <vector>

struct ParticleAoS {
    float x, y, z;
    bool active;
};

std::vector<ParticleAoS> particles;
```

```
#include <vector>

struct ParticleSoA {
    std::vector<float> x, y, z;
    std::vector<bool> active;
};
```

Question 1:

Which Layout do you expect to perform better when iterating over positions only? Why?

Part B: Observation

Run the provided benchmarks

- `aos_iteration`
- `soa_iteration`

Record

Benchmark	Execution Time	Cache Miss Statistics
<i>aos_iteration</i>		
<i>soa_iteration</i>		

Part C: Reflection

1. Did the observed results match your prediction?

2. Which memory effects explain the difference?

3. How might this influence real system design?
