AP COMPUTER SCIENCE PRINCIPLES • EXERCISE SHEET

4.3 Parallel and Distributed Computing

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

Build the skills to answer exam questions on **parallel and distributed computing**.

You must be able to:

- distinguish **sequential** 顺序 from **parallel** 并行 computing
- explain how **distributed** 分布式 computing spreads a task across computers
- calculate the **speedup** 加速比 from parallel processing
- explain why speedup is limited by the parts that must run sequentially

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Sequential vs parallel

Sequential computing runs steps one after another; **parallel** computing runs steps **at the same time** on multiple processors.

■ Distributed computing

Spreads a task across **multiple computers** working together.

■ Speedup

$$\text{speedup} = \frac{\text{sequential time}}{\text{parallel time}}.$$

A 60 s job done in 20 s has a speedup of 3. Speedup is **limited** by the parts that must still run sequentially.

2 Practice

2.1 State the difference between sequential and parallel computing. [2]

2.2 A task takes 40 s sequentially and 10 s in parallel. Find the speedup. [2]

2.3 State what distributed computing does. [1]

3 Exam-style questions

3.1 Parallel computing runs steps [1]

- **A** one after another
- **B** at the same time
- **C** never
- **D** in random order

3.2 Speedup is [1]

- **A** parallel time − sequential time
- **B** sequential time ÷ parallel time
- **C** parallel × sequential time
- **D** always 1

3.3 A job takes 100 s on one processor and 25 s split across four.

(a) Find the speedup. [2]

(b) State what limits parallel speedup. [1]

4 Go further

- work through the **4.3 Parallel and Distributed Computing** lesson on the **Learn** page;

- read the **Computer Systems and Networks** section of the AP Computer Science Principles handout on the **Know** page.

Solutions

2.1 sequential runs steps one after another; parallel runs steps at the same time.

2.2 speedup $= \dfrac{40}{10} = 4$.

2.3 it spreads a task across multiple computers.

3.1 B.

3.2 B.

3.3 (a) $\dfrac{100}{25} = 4$. (b) the parts of the task that must run sequentially.