

First Name: \_\_\_\_\_ Last Name: \_\_\_\_\_

1. Voltage = 4 V, frequency = 1 GHz, and dynamic power = 3 W. Frequency is increased to 6 GHz. What is the new dynamic power?
2. Voltage = 4 V, frequency = 1 GHz, and dynamic power = 3 W. Voltage is decreased to 2 V. What is the new dynamic power?
3. Processor A has 75% of the capacitive load of processor B. Processor A also has a 20% voltage reduction and 10% shrink in frequency. What is the relative impact on dynamic power?
  - $0.75 \times 0.802 \times 0.90 = 0.432$
  - $0.75 \times 0.202 \times 0.10 = 0.003$
  - $0.75 \times 0.802 \times 0.90 = 0.432V$
4. Which improvement has a bigger impact on power?
  - 25% reduction in voltage
  - 25% reduction in frequency switching
5. In the past 20 years, voltages have decreased from 5 V to 1 V. Why don't manufacturers continue to lower voltages to reduce power consumption?
  - Further lowering of voltage results in transistor leakage.
  - Voltage has no impact on power
6. Over the past 30 years, processor frequencies have continued to increase.
  - True
  - False
7. From the mid-1980s to early-2000s, processor performance improved each year at an average of 52%.
  - True
  - False
8. Growth in processor performance slowed in 2002.
  - True
  - False

9. Power was a factor in the slowing of processor performance growth.

- True
- False

10. Manufacturers continue to design single processor systems and increase processor performance through new technology-driven improvements.

- True
- False

11. As computing systems move to multicore microprocessors, programmers \_\_\_\_\_ to obtain performance benefits.

- don't need to change any code
- need to rewrite their programs

12. Parallel programming seeks to improve program \_\_\_\_\_.

- pipelining
- performance
- correctness

13. How should programmers write code to maximize the benefits of parallel programming?

- Run all program tasks on a single processor
- Run programs in a round-robin fashion to ensure even wear of processors
- Divide a program into sub-tasks so all processors run about the same amount of time

14. Parallel programming becomes more difficult as the number of processor cores increases.

- True
- False

15. A program runs in 100 seconds. Multiply operations are responsible for 30 of those seconds. If extensive designer effort is applied such that multiply operations are made to run 2 times faster, what is the program's new execution time?

16. If some aspect of a computer accounts for 50% of program execution time, what is the limit on how many times faster programs can run if engineers focus on improving that aspect?

17. Google's warehouse scale computer uses 5% of the peak power when running at 10% utilization.

- True
- False

18. Designers must choose between energy and performance. If a computer is designed for improved performance, then the computer's energy consumption will increase.

- True
- False

19. Consider the following performance measurements for a program:

Measurement	Computer A	Computer B
Instruction count	10 billion	8 billion
Clock rate	4 GHz	4 GHz
CPI	1.0	1.1

a. Which computer has the higher MIPS rating?

- Computer A
- Computer B

b. Which computer is faster for that program?

- Computer A
- Computer B

20. The most reliable method to evaluate performance is execution time.

- True
- False

21. Software developers do not need an understanding of hardware to write efficient programs.

- True
- False

22. Power limitations have forced computer designers to exploit parallelism to improve system performance.

- True
- False

23. An instruction set is a particular program provided in the language of a computer.

- True
- False

24. The instruction sets of different computers are quite similar to one another.

- True
- False

25. Instructions, as well as data, can be stored in memory as numbers.

- True
- False

Given:  $b = 2$ ,  $c = 5$ ,  $d = 1$ .

26. add a, b, c , Final value of a is \_\_\_\_\_.

27.

add t, d, c

add a, t, c

Final value of a is \_\_\_\_\_

28.

sub t, c, b

add a, t, d

Final value of a is \_\_\_\_\_.

29. Order the assembly instructions to calculate the expression:  $a = b + c + d - e$

- add t0, b, c
- add t1, t0, d
- sub a, t1, e

1

2

3

30. For a given function, which programming language likely takes the most lines of source code?

- Java
- C
- MIPS assembly language

1 (Requires most lines)

2

3 (Requires fewest lines)

31. Indicate whether each name refers to a MIPS register.

a. \$s3

Yes

No

b. \$s9

Yes

No

c. \$t9

Yes

No

d. a2

Yes

No

e. \$zero

Yes

No

f. \$one

Yes

No

h. Memory[0]

Yes

No