4.4 Hardware-Software design issues on embedded system (ACtE0404)

Embedded Systems Overview

1. What is an embedded system?
   - A) A general-purpose computer
   - B) A system designed to perform specific tasks
   - C) A desktop PC
   - D) A supercomputer

2. Which of the following is an example of an embedded system?
   - A) Washing machine controller
   - B) Personal computer
   - C) Mainframe
   - D) Server

3. The primary characteristic of an embedded system is:
   - A) Flexibility for multiple tasks
   - B) Dedicated function or task
   - C) High computational power
   - D) User-friendly interface

4. Which of the following is typically used in embedded systems?
   - A) Microcontroller
   - B) Mainframe processor
   - C) Desktop CPU
   - D) GPU

5. Real-time embedded systems must:
   - A) Process data with minimal delay
   - B) Use only high-level languages
   - C) Operate without user input
   - D) Be connected to the internet

6. Embedded systems are commonly found in:
   - A) Consumer electronics
   - B) Military applications
   - C) Industrial automation
   - D) All of the above

7. The software in embedded systems is usually stored in:
   - A) RAM
   - B) ROM/Flash memory
   - C) Hard drive
   - D) Cloud storage

8. An embedded system designed to control a simple task is called:
   - A) Hard real-time system
   - B) Soft real-time system
   - C) Single-function system
   - D) Hybrid system

9. Which of the following is NOT a characteristic of embedded systems?
   - A) Small form factor

- B) Dedicated function
- C) High power consumption
- D) Resource-constrained environment

10. The design process of embedded systems typically begins with:
    - A) Hardware selection
    - B) Requirements specification
    - C) Software coding
    - D) User interface design

Classification of Embedded Systems

11. Embedded systems can be classified based on:
    - A) Performance and functional requirements
    - B) Programming language used
    - C) The type of microcontroller
    - D) User interface complexity

12. Which classification involves handling tasks that must be completed within strict time constraints?
    - A) Standalone systems
    - B) Real-time systems
    - C) Networked systems
    - D) Mobile embedded systems

13. A soft real-time embedded system:
    - A) Requires tasks to be completed within a strict deadline
    - B) Allows deadlines to be missed occasionally without severe consequences
    - C) Cannot tolerate any delay
    - D) Does not involve any timing constraints

14. Which of the following is an example of a hard real-time system?
    - A) Video game console
    - B) Airbag control system
    - C) Smart thermostat
    - D) Printer

15. Standalone embedded systems:
    - A) Do not require a host system for operation
    - B) Always need to be connected to a network
    - C) Are only used in industrial settings
    - D) Depend on cloud connectivity

16. Networked embedded systems communicate using:
    - A) Direct memory access
    - B) Network protocols like TCP/IP
    - C) USB interfaces
    - D) Keyboard and mouse

17. An embedded system in a mobile phone is an example of a:
    - A) Real-time system
    - B) Mobile embedded system
    - C) Standalone system
    - D) Hybrid system

18. Which of the following categories would an embedded system in a car's navigation system fall under?
    - A) Standalone system
    - B) Real-time system
    - C) Mobile embedded system
    - D) Networked system

Custom Single-Purpose Processor Design

19. A custom single-purpose processor is designed for:
    - A) General-purpose computing tasks
    - B) A specific task or application
    - C) Running multiple operating systems
    - D) High-level programming

20. The primary advantage of a custom single-purpose processor is:
    - A) Lower power consumption
    - B) Faster execution of specific tasks
    - C) Ease of programming
    - D) Flexibility in multiple applications

21. Custom single-purpose processors are often optimized for:
    - A) Versatility in various applications
    - B) Efficient performance in a single application
    - C) Running high-level software
    - D) Multi-threading

22. Which of the following is NOT typically a characteristic of custom single-purpose processors?
    - A) High speed for specific tasks
    - B) High power efficiency
    - C) General-purpose processing capabilities
    - D) Small size

23. A good example of a custom single-purpose processor is:
    - A) Central Processing Unit (CPU)
    - B) Digital Signal Processor (DSP)
    - C) Graphics Processing Unit (GPU)
    - D) Printer controller

24. The design of custom single-purpose processors often begins with:
    - A) Writing software code
    - B) Designing hardware logic
    - C) Selecting an operating system
    - D) Choosing a high-level language

Optimizing Custom Single-Purpose Processors

25. Optimization of custom single-purpose processors typically focuses on:
    - A) Maximizing flexibility
    - B) Minimizing power consumption and size
    - C) Supporting multiple operating systems
    - D) Enhancing user interface design

26. What is the primary goal of optimizing a custom single-purpose processor?
    A) To increase general-purpose computing capabilities
    B) To enhance performance for a specific application
    C) To simplify the instruction set
    D) To expand the processor's core count

27. Which optimization technique is used to reduce the number of cycles needed to execute a specific instruction in a custom processor?
    A) Pipelining
    B) Superscalar execution
    C) Instruction set extension
    D) Out-of-order execution

28. In optimizing a custom single-purpose processor, what is the benefit of using specialized functional units?
    A) Increased versatility for general tasks
    B) Enhanced performance for specific operations
    C) Reduced processor speed
    D) Simplified hardware design

29. Which technique involves increasing the number of instructions that can be processed simultaneously to improve performance?
    A) Branch prediction
    B) Instruction-level parallelism (ILP)
    C) Dynamic voltage and frequency scaling (DVFS)
    D) Memory interleaving

30. What is one of the challenges associated with optimizing custom single-purpose processors?
    A) Balancing between performance and power consumption
    B) Ensuring compatibility with all software platforms
    C) Simplifying the hardware architecture
    D) Expanding the number of general-purpose registers

31. When designing a custom single-purpose processor, what does "instruction set customization" involve?
    A) Modifying the existing set of instructions to better suit specific tasks
    B) Increasing the number of general-purpose registers
    C) Simplifying the processor's control unit
    D) Enhancing the processor's clock speed

<u>Basic Architecture and Operation</u>

32. What is a key characteristic of a custom single-purpose processor?
    - A) General-purpose versatility
    - B) High-level programming support
    - C) Specific functionality optimization
    - D) Extensive multimedia capabilities

33. Which type of architecture is usually optimized for single-purpose processors?
    - A) RISC (Reduced Instruction Set Computer)
    - B) CISC (Complex Instruction Set Computer)
    - C) VLIW (Very Long Instruction Word)

- D) Superscalar

34. Which aspect of a custom single-purpose processor can be optimized for specific applications?
    - A) Instruction set architecture
    - B) Cache size
    - C) Number of cores
    - D) Bus bandwidth

Programmer's View

35. From the programmer's perspective, what does the "programmer's view" of a processor refer to?
    - A) Hardware architecture design
    - B) Memory hierarchy
    - C) Instruction set and registers
    - D) Clock speed and power consumption

36. In the context of single-purpose processors, what is typically the most significant factor affecting programming ease?
    - A) Instruction set complexity
    - B) Cache memory size
    - C) Number of I/O ports
    - D) Power efficiency

37. Which programming model is most commonly used for custom single-purpose processors?
    - A) Assembly language programming
    - B) High-level language programming
    - C) Functional programming
    - D) Object-oriented programming

38. When designing custom instructions for a single-purpose processor, what must be carefully considered?
    - A) Compatibility with existing software
    - B) Hardware cost
    - C) Instruction encoding and decoding efficiency
    - D) Software library availability

39. What is the typical role of the Instruction Set Architecture (ISA) in a single-purpose processor?
    - A) Defining the processor's clock speed
    - B) Determining the processor's power consumption
    - C) Specifying the set of instructions the processor can execute
    - D) Managing the processor's heat dissipation

Development Environment

40. Which tool is essential for developing software for custom single-purpose processors?
    - A) Integrated Development Environment (IDE)
    - B) Graphics Processing Unit (GPU)
    - C) Database Management System (DBMS)
    - D) Web Browser

41. In the development environment for custom processors, what does a simulator typically do?
    - A) Execute software on real hardware
    - B) Simulate the behaviour of the processor for testing
    - C) Manage power consumption
    - D) Optimize memory usage

42. What is a critical aspect to consider when choosing a development environment for custom processors?
    - A) Support for target processor architecture
    - B) Availability of multimedia features
    - C) Ease of web integration
    - D) Cost of licenses for commercial software

Application-Specific Instruction-Set Processors (ASIPs)

43. What distinguishes an Application-Specific Instruction-Set Processor (ASIP) from a general-purpose processor?
    - A) ASIPs have a broader instruction set
    - B) ASIPs are designed for specific application domains
    - C) ASIPs offer higher clock speeds
    - D) ASIPs have more general-purpose registers

44. Which aspect of ASIPs is tailored to specific applications?
    - A) Instruction set
    - B) Clock frequency
    - C) Cache size
    - D) Power consumption

45. In designing an ASIP, which factor is typically prioritized?
    - A) General-purpose performance
    - B) Customization for specific application requirements
    - C) Compatibility with all software platforms
    - D) High-level programming language support

46. Which of the following is a potential benefit of using an ASIP?
    - A) Increased development time
    - B) Improved performance for targeted tasks
    - C) Higher hardware cost
    - D) Decreased power efficiency

47. What is a common challenge in developing ASIPs?
    - A) Balancing between customizability and complexity
    - B) Ensuring compatibility with existing software
    - C) Achieving higher clock speeds
    - D) Integrating with general-purpose hardware

Optimization Techniques

48. What is one common optimization technique used for custom single-purpose processors?
    - A) Pipelining
    - B) Virtualization
    - C) Out-of-order execution

- D) Superscalar execution

49. How does pipelining benefit custom single-purpose processors?
    - A) By increasing the number of execution units
    - B) By allowing multiple instructions to be processed simultaneously
    - C) By reducing power consumption
    - D) By simplifying the instruction set

50. What is the purpose of instruction-level parallelism (ILP) in processor optimization?
    - A) To enable multiple instructions to execute in parallel
    - B) To reduce the number of processor registers
    - C) To enhance memory bandwidth
    - D) To simplify the instruction set

Optimization Strategies and Challenges

51. Which strategy can be used to minimize the power consumption of custom processors?
    - A) Dynamic voltage and frequency scaling (DVFS)
    - B) Increasing the processor clock speed
    - C) Expanding the instruction set
    - D) Reducing the number of functional units

52. What is one approach to improving the memory bandwidth of a custom processor?
    - A) Implementing a wider data bus
    - B) Reducing the number of processor cores
    - C) Increasing cache size
    - D) Simplifying the instruction set

53. Which technique is often used to reduce latency in custom processors?
    - A) Cache optimization
    - B) Increasing clock speed
    - C) Expanding the number of I/O ports
    - D) Adding more cores

54. In optimizing a processor's performance, what does "branch prediction" aim to do?
    - A) Reduce delays caused by branch instructions
    - B) Increase the number of branches in the instruction set
    - C) Improve power efficiency
    - D) Enhance the processor's I/O capabilities