

This test consists of 40 equally weighted questions.

1. Identify the rule of inference used in the following:

If it rains today, the flood gates will open. The flood gates did not open today. Therefore, it did not rain.

- a. modus tollens
- b. hypothetical syllogism
- c. modus ponens
- d. disjunctive syllogism

2. Identify the rule of inference used in the following:

If I work all night on this homework, then I can answer all the exercises. If I answer all the exercises, I will understand the material. Therefore, if I work all night on this homework, then I will understand the material.

- a. modus tollens
- b. hypothetical syllogism
- c. modus ponens
- d. disjunctive syllogism

3. The following argument is valid:

$$p \rightarrow q$$

$$\neg p$$

$$\therefore \neg q$$

- a. True
- b. False

4. Analyze the following argument:

- If n is a real number such that $n > 1$, then $n^2 > 1$. Suppose that $n^2 > 1$, then $n > 1$.
- It is valid.
 - It is not valid because it begs the question.
 - It is not valid because it affirms the hypothesis.
 - It is not valid because it affirms the conclusion.
5. Analyze the following argument:
- If n is a real number such that $n > 2$, then $n^2 > 4$. Suppose that $n \leq 2$, then $n^2 \leq 4$.
- It is valid.
 - It is not valid because it begs the question.
 - It is not valid because it denies the hypothesis.
 - It is not valid because it affirms the conclusion.
6. The following argument is valid:
- Lynn works part time or full time
 If Lynn does not play on the team, then she does not work part time
 If Lynn plays on the team, she is busy
 Lynn does not work full time
 Therefore Lynn is busy
- True
 - False
7. The statement “I visited New Orleans last month” logically implies “Someone visited New Orleans last month.”
- True
 - False
8. You wish to prove theorem of the form “if p then q ”. To use the method of direct proof, what do you assume and what do you prove?
- assume p , prove q .*
 - assume $\neg q$, prove p .*
 - assume $\neg q$, prove $\neg p$.*
 - assume $p \wedge \neg q$, prove otherwise.*

9. You wish to prove theorem of the form “if p then q ”. To use the method of indirect proof, what do you assume and what do you prove?
- assume p , prove q .*
 - assume $\neg q$, prove p .*
 - assume $\neg q$, prove $\neg p$.*
 - assume $p \wedge \neg q$, prove otherwise.*
10. You wish to prove theorem of the form “if p then q ”. To use the method of contradiction, what do you assume and what do you prove?
- assume p , prove q .*
 - assume $\neg q$, prove p .*
 - assume $\neg q$, prove $\neg p$.*
 - assume $p \wedge \neg q$, prove otherwise.*
11. The method of mathematical induction is used to prove propositions of the form: $\exists n P(n)$.
- True
 - False
12. The step that proves $P(1)$ is called the basis step.
- True
 - False
13. Why is mathematical induction valid?
- It formalizes symbolic logic.
 - It follows from the well-ordering property.
 - It uses concrete examples as a means of proof by cases.
 - It is widely accepted as valid.
14. $2 \mid (n^2 + 3n)$ for all $n \geq 1$. (*Hint: Use mathematical induction.*)
- True
 - False
15. $2n + 3 \leq 2^n$ for all $n \geq 4$. (*Hint: Use mathematical induction.*)
- True
 - False

16. A recursive definition specifies the value of the function at zero and then gives a rule for finding its value at a given integer from its values at smaller integers.

- a. True
- b. False

17. What is a reasonable name for the following procedure?

```
procedure mystery (x, y : integers)
if x = 0 then y := 1
else y := x*mystery(x-1)
```

- a. Fibonacci
- b. Factorial
- c. Max
- d. Product

18. Recursive functions are well-defined as a consequence of mathematical induction.

- a. True
- b. False

19. What is a reasonable name for the following procedure?

```
procedure mystery (x, y : non-negative integers)
if x = 0 then answer := y
else answer := mystery(y mod x, x)
return(answer)
```

- a. Binary Search
- b. Power
- c. Search
- d. GCD

20. One of the common uses of recursive definitions is to define well-formed formulae in various systems.

- a. True
- b. False

21. Σ^* is:

- a. the power set of Σ .
- b. the set of strings over the alphabet Σ .
- c. limited to the letters of the English alphabet.
- d. limited to the non-negative integers.

22. Assume you have constructed a proof that $P(k)$ is true for $3 \leq k \leq n$. The proof of $P(3)$ is called the:
- basis step.
 - inductive step.
 - recursive step.
 - None of the above.
23. Continuing the above example, the _____ step shows that $P(3) \rightarrow P(4)$.
- basis step.
 - inductive step.
 - recursive step.
 - None of the above.
24. $n^2 > 2^n$ whenever n is an integer greater than 4.
- True
 - False
25. A procedure that starts with the value of the function at 1 and then successively applies the definition to find the value of the function at successively larger integers is said to be:
- recursive.
 - iterative.
 - factorial.
 - None of the above.
26. The proof of the correctness of a program is called:
- verification.
 - induction.
 - inference.
 - validation.
27. If you split a program into a series of subprograms and show that each subprogram is correct, then you have established the program is correct by means of:
- verification.
 - induction.
 - inference.
 - validation.

28. A program is said to be _____ if it produces the correct output for every possible input.
- correct
 - complete
 - partially correct
 - None of the above.
29. If the correct answer is obtained when a program terminates, it is said to be:
- correct.
 - complete.
 - partially correct.
 - None of the above.
30. To show that a conditional statement S in a program is correct, it is necessary to show that:
- when the condition is true, S executes.
 - when the condition is false, S does not execute.
 - both A and B.
 - None of the above.

31. Analyze the following rule of inference:

$$\frac{(p \wedge \text{condition})\{S_1\}q}{(p \wedge \neg \text{condition})\{S_2\}q}$$

This inference rule is best described as:

- if...then
 - while
 - compositional
 - loop invariant
32. The notation $p\{S\}q$ is called a Hoare triple.
- True
 - False
33. The notation $p\{S\}q$ indicates the program or subprogram S is partially correct with respect to the initial assertion p and the final assertion q .
- True
 - False

34. Analyze the following rule of inference:

$$\frac{p\{S_1\}q}{q\{S_2\}r}$$

This inference rule is best described as:

- a. if...then
 - b. while
 - c. compositional
 - d. loop invariant
35. Given the initial assertion is true and the following rule of inference, what is the truth value of final assertion $y = 2$?

if $x < 0$ then
 $y := -2|x|/x$
else if $x > 0$ then
 $y := 2|x|/x$
else if $x=0$ then
 $y := 2$

- a. True
 - b. False
36. A sequence is a discrete structure used to define a set.
- a. True
 - b. False
37. What is the lower limit of the index of summation for $\sum_{j=1}^{100} \frac{1}{j}$?
- a. 0
 - b. 1
 - c. 100
 - d. None of the above.
38. What is the value of $\sum_{i=2}^5 i^2$?
- a. 32
 - b. 54
 - c. 55
 - d. 65

39. A sequence of the form $a, ar, ar^2, ar^3, ar^4, \dots, ar^k$ is called a harmonic progression.
- True
 - False
40. To compute a double summation,
- expand the outer summation, then compute the inner summation.
 - expand the inner summation, then compute the outer summation.
 - expand the summation indices, then compute the function.
 - None of the above.