





Department: Mathematics

Major: Statistics & Comp. Sc.

قواعد ودلالات لغات البرمجة: Course Title Date:23/1/2024

Time: 2 hr

**Mark: 70** 

Date: 25/1/2024

# ممنوع تواجد الهواتف المحمولة داخل اللجان وممنوع الإجابة بالقلم الرصاص

The Exam Consists of 5 Questions in 3 pages

#### Answer All the Following Questions

#### Question 1: True or False

[12 Marks]

1- [T/F] The following BNF gives + precedence over \* and forces + to be right associative.

$$<$$
assign $> \rightarrow <$ id $> = <$ expr $> <$ id $> \rightarrow$  A | B | C

$$<$$
factor $> \rightarrow$  (  $<$ expr $>$  )

2- [T/F] The following grammar is ambiguous:

$$\langle S \rangle \longrightarrow \langle A \rangle$$

$$\langle A \rangle \rightarrow \langle A \rangle + \langle A \rangle | \langle id \rangle$$

$$\langle id \rangle \rightarrow a \mid b \mid c$$

3- [T/F] Static type checking is better than dynamic type.

4- [T/F] In functional programming, the program expressed as rules in formal logic.

5- [T/F] C++ pointers are powerful and very flexible but not reliably used.

6- [T/F] Semantics is defined using some kind of rules.

## Question 2: Choose the correct answer.

[10 Marks]

1- A program is computer coding of an algorithm that ......

a. Takes input only

- b. Performs some calculations on the input only.
- c. Generates output only
- d. All of the above.
- 2- The advantage of a typeless language is ......
  - a. flexibility
- b. readability
- c. reliability
- d. none of the above
- - a. flexibility
- b. writability
- c. reliability
- d. none of the above

4- Which of these is an example of a production rule?

- a.  $A \rightarrow AB$
- b.  $X+Y2 \rightarrow 17$
- c.  $R \rightarrow (B \rightarrow 5)$
- d. X2 + Y3
- 5- What type of object is enclosed in angle brackets <> in BNF?
  - a. Definitive
- b. Terminal
- c. non-terminal
- d. Special

## Question 3: Consider the following JavaScript skeletal program: [18 Marks]

```
// The main program
var x;
function sub1() {
  var x;
  function sub2() {
    ...
}
function sub3() {
    ...
}
```

Assume that the execution of this program is in the following unit order:

- main calls sub1
- sub1 calls sub2
- sub2 calls sub3
- a) Assuming **static scoping**, in the following, which declaration of x is the correct one for a reference to x?
  - 1. sub1
  - 2. sub2
  - 3. sub3
- b) Repeat part a but assume dynamic scoping.

### Question 4:

[18 Marks]

1. Using the following grammar,

show a parse tree and a leftmost derivation for the following statement:

$$A = (A + B) * C$$

2. Consider the following grammar:

$$\langle S \rangle \rightarrow \langle A \rangle$$
 a  $\langle B \rangle$  b  
 $\langle A \rangle \rightarrow \langle A \rangle$  b | b  
 $\langle B \rangle \rightarrow$  a  $\langle B \rangle$  | a

Which of the following sentences are in the language generated by this grammar?

- 1. baab
- 2. bbbab
- 3. bbaaaaaS
- 4. bbaab

Question 5: [12 Marks]

Let the function fun be defined as

```
int fun(int* k) {
*k += 4;
return 3 * (*k) - 1;
}
```

Suppose Fun is used in a program as follows:

```
void main() {
int i = 10, j = 10, sum1, sum2;
sum1 = (i / 2) + fun(&i);
sum2 = fun(&j) + (j / 2);
}
```

What are the values of sum1 and sum2

- 1. operands in the expressions are evaluated left to right?
- 2. operands in the expressions are evaluated right to left?

With Best Wishes Dr. Tamer Emara