300 LEVEL PAST QUESTIONS

Department of Computer Science

2017/2018 First Semester Examination

COSC311: Organization of Programming Languages

Instruction: Answer only four (4) questions **Duration: 120mins**

Question 1

a. List and explain five different benefits of studying concepts of programming languages (5 marks)

b. Explain and give at least two characteristics to support the following Evaluation Criteria

i. Writability (1 mark)

ii. Readability (1 mark)

iii. Reliability (2 marks)

iv. Cost (1 mark)

c. Trace and write the output of the following C program (5 marks)

```
#include <stdio.h>
int main(){
        int i, j, *ip, myArray[5] = {2,3,5,7,11};
        ip = &myArray[2];
        for(i= 0; i<5; i++)
                printf("myArray[%d] = %d\n", i, *(myArray+i));
        *(ip+1) = 4;
        *(ip-1) += 11;
        j = *(ip-2);
        for(i=0; i<5; i++)
                printf("myArray[%d] = %d\n", i, *(myArray+i));
        return 0;
}
```

Question 2

a. Use the Grammar below to answer questions i and ii

<Stmt> → <Abstract>
<Abstract> → <Abstract> + <Abstract> | <ident>
<ident> → a | b | c

i. Show the derivations of: a + b + c (2 marks)

ii. Prove that the grammar is ambiguous with pass tree (4 marks)

b. Convert the following:

i. EBNF to BNF: (3 marks)

<expr> → <term> {(+ | -) <term>}
<term> → <factor> {(* | /) <factor>}
<factor> → <exp> { ** <exp>}
<exp> → (<expr>) | id

ii. BNF to EBNF: (3 marks)

<assign> → <id> = <expr>
<id> → A | B | C
<expr> → <expr> + <term> | <term>
<term> → <term> * <factor> | <factor>
<factor> → (<expr>) | <id>

c. Rewrite the BNF in (b. ii.) above to give + precedence over * and force + to be right associative. (3 marks)

...0 Minutes

Question 3

a. A variable can be characterized as a sextuple of attributes. list and explain any five of these attributes (5 marks)

b. Consider the following skeletal program:

```
var x = 3;
function main(){
    function sub2() {
        var x = 6;
        sub1();
    }
    x = 9;
    sub2();
    function sub1() {
        var y = x;
    }
}
```

i. What is the value x referenced in sub1() assuming static scoping (2.5 marks)

ii. What is the value x referenced in sub1() assuming dynamic scoping (2.5 marks)

c. Consider the following skeletal program:

```
void sub1() {
    int w, x;
    ...                                   (i)
}
void sub2() {
    int x, y;
    ...                                   (ii)
    sub1();
}
void main() {
    int y, z;
    ...                                   (iii)
    sub2();
}
```

i. What is the referencing environment for the point marked (i), listing out the visible and hidden variables. (2 Marks)

ii. What is the referencing environment for the point marked (ii), listing out the visible and hidden variables.(1.5 Marks)

iii. What is the referencing environment for the point marked (iii), listing out the visible and hidden variables. (1.5 Marks)

Question 4

a. Define the following (5 Marks):
   i. Data type
   ii. Strongly typed language
   iii. Ordinal type
   iv. Enumeration type
   v. Subrange type

b. Describe the three string length options (3 Marks).

c. Create an arbitrary 3 by 3 matrix and show how the values would be stored in:
   i. Row major order (1.5 Marks)
   ii. Column major order (1.5 Marks)

d. Let a 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:

i. If the operands in the expressions are evaluated left to right? (2 Marks)

ii. If the operands in the expressions are evaluated right to left? (2 Marks)

Question 5

a. What are the pros and cons of using unique closing reserved words on compound statements? (2 Marks)

b. What is/are the design issue(s) for all selection and iteration control statements? (6 Marks)

c. What is the difference between the *for* statement of C++ and that of Java? (1 Mark)

d. What are the design issues for logically controlled loop statements?(2 Marks)

e. Given four integer variables, q1, q2, q3, and q4, rearrange the values of the four using guarded commands so that $q1 \leq q2 \leq q3 \leq q4$.(4 Marks)

Question 6

a. What are the three general characteristics of subprograms? (3 Marks)

b. What does it mean for a subprogram to be active? (2 Marks)

c. Consider the following program written in C syntax:

```
void main() {
        int value = 2, list[5] = {1,3,4,7,9};
        swap(value, list[0]);
        printf("%d and [%d,%d,%d,%d,%d]\n",value,list[0],list[1],list[2],list[3],list[4]);
        swap(list[0], list[1]);
        printf("%d and [%d,%d,%d,%d,%d]\n",value,list[0],list[1],list[2],list[3],list[4]);
        swap(value, list[value]);
        printf("%d and [%d,%d,%d,%d,%d]\n",value,list[0],list[1],list[2],list[3],list[4]);
        return 0;
}
void swap(int a, int b) {
        int temp;
        temp = a;
        a = b;
        b = temp;
}
```

For each of the following parameter-passing methods, what is the output of the program?

i. Passed by value (2.5 Marks)

ii. Passed by reference (2.5 Marks)

iii. Passed by name (2.5 Marks)

iv. Passed by value-result (2.5 Marks)

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2018/2019 Session
First Semester Test 1
COSC311: Concept of Programming Languages

Date: May 11, 2019 Time Allowed: 30 Minutes

Instructions:
1. Attempt ALL questions.
2. Write all your answers in the spaces provided on this Question Paper.

Student's Registration Number: U17CS2030 Signature:

1. (a) List five (5) reasons for studying the course "Concept of Programming Languages"
i- Increase ability to learn new languages.
ii- Better understanding of significance of implementation.
iii- Increase ability develop ideas
iv- Overall Computing.
v- Improve how the syntax of the language is written. 04

(b) Mention and explain two (2) major influences on a language design
(i) Computer Architecture: languages develop that involves the prevalent computer architecture known as Von Neumann architecture. The Von-Neumann Architecture seperate memory from CPU and instruction and data are piped from memory to CPU.

ii) Program Design methodology: new software development methodology (i.e new Object oriented programming) led to new programming paradigm, by extension new system design. 03

(c) Mention three (3) features of a programming language that can contribute to its readability.
i- Overall simplicity
ii- Orthogonality
iii- Data types 03

2. (a) Generate the statement A = A * (B + (C * A)) using the following grammar

<assign> → <id> = <expr>
<id> → A | B | C
<expr> → <id> + <expr>
| <id> * <expr>
| (<expr>)
| <id>

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

<assign> → <id> = <expr>
A = <expr>
A = <id> * <expr>
A = A * <expr>
A = A * (<expr>)
A = A * (<id> + <expr>)
A = A * (B + <expr>)
A = A * (B + (<expr>))
A = A * (B + (<id> * <expr>))
A = A * (B + (C * <expr>))
A = A * (B + (C * <id>))
A = A * (B * (C * A))

05

(c) Study the C program below and write its output.

```
#include <stdio.h>
int main(){
   int i=3; j=7, *ip;
   ip = &i;
   *ip = 5;
   ip = &j;
   *ip += 11;
   i += *ip;
   printf("i = %d\n", i);
   printf("j = %d\n", j);
   printf("*ip = %d\n", *ip);
   return 0;
}
```

Output:

23
18
18

05