Name (Surname, Firstname MI.) ____ **ID No.:** ________________

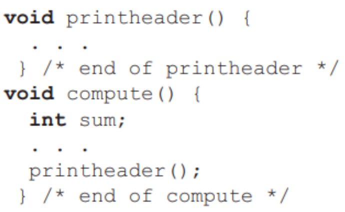
CS 3204N Programming Languages **Chapter 5 and 6 Exam** **March 20, 2023**

I. (90 points) Chapter 5 – Names, Bindings, and Scopes

1) Define the following terms: **[18 points]**

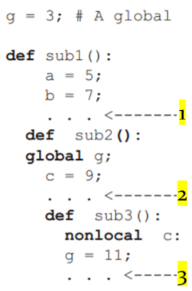
a. variable	b. name	c. value (of a variable)
d. explicit allocation	e. allocation	f. scope
g. reference environment	h. active substitution	i. initialization

2) How is case sensitivity of variables an advantage and a disadvantage to a language's readability and writability? **[3 points]**
3) Cite a potential problem about reserved words and support your answer with an example language. **[2 points]**
4) A variable can be characterized as a sextuple of attributes. Name them. **[3 points]**
5) Differentiate l-values from r-values. **[3 points]**
6) What is aliasing and what are the language design criteria does this concept negatively affect? **[3 points]**
7) What is binding? When and where can bindings happen? **[3 points]**
8) Differentiate static binding from dynamic binding. **[2 points]**
9) What constitutes an implicit declaration? What things can perform implicit variable type binding? What are the problems brought about by implicit declarations and how are they resolved? **[5 points]**
10) Name an advantage and two disadvantages of dynamic type binding and explain each. **[5 points]**
11) Name the four categories of variables according to their lifetimes, and for each category, state an advantage and disadvantage. **[12 points]**
12) Differentiate static scoping from dynamic scoping. **[3 points]**
13) Cite two issues of dynamic scoping. **[4 points]**
14) Discuss the scope and lifetime of *sum* in the code fragment below (Fig 1). **[4 points]**



```
void printheader() {
  . . .
 } /* end of printheader */
void compute() {
  int sum;
  . . .
  printheader();
 } /* end of compute */
```

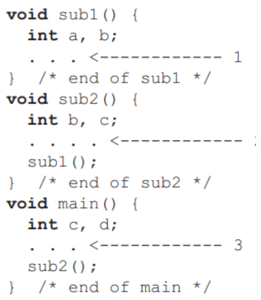
(Fig 1)



```
g = 3; # A global

def sub1():
    a = 5;
    b = 7;
    . . . <-------1
  def  sub2():
  global g;
    c = 9;
    . . . <-------2
    def  sub3():
      nonlocal  c:
      g = 11;
      . . . <-----3
```

(Fig 2)



```
void sub1() {
  int a, b;
  . . . <------------ 1
}  /* end of sub1 */
void sub2() {
  int b, c;
  . . . . <------------
  sub1();
}  /* end of sub2 */
void main() {
  int c, d;
  . . . <------------ 3
  sub2();
}  /* end of main */
```

(Fig 3)

15) a. Identify the referencing environments of points 1, 2, and 3 in the program from (Fig 2). **[3 points]**

    b. Identify the referencing environments of points 1, 2, and 3 in the program from (Fig 3). **[3 points]**
16) What are named constants? What are their roles and importance in language design? **[3 points]**
17) Distinguish the usage of the *const* and *readonly* keywords in C#. **[3 points]**
18) Some programming languages are typeless. What are the obvious advantages and disadvantages of having no types in a language? **[4 points]**
19) Describe a situation when a history-sensitive variable in a subprogram is useful. **[2 points]**
20) Senior Police Officer (SPO) Tintin claims that complete understanding of the binding times for the attributes of program entities is a prerequisite for understanding the semantics of a programming language. Is his claim meritorious? Explain your answer with examples. **[2 points]**

II. (140 points) Chapter 6 – Data Types

21) Define the following terms: **[24 points]**

a. data type	b. descriptor	c. array
d. generic arrays	e. associative arrays	f. record
g. fully qualified reference (to a record field)	h. list comprehension	i. pointer
j. reference-type variable	k. coercion	l. derived type

22) What are type systems? Cite three (3) of their uses. **[4 points]**

23) Describe a design issue fundamental to all data types. **[2 points]**

24) Distinguish between precision and range. **[3 points]**

25) Why is one’s complement not used in representing negative integers? **[2 points]**

26) a. Illustrate the representation of a floating point number based on IEEE Floating-Point Standard 754. **[2 points]**

b. Using the standard above, show the binary representation of -12.5. **[5 points]**

27) a. How does a decimal value waste memory space? **[2 points]**

b. When can a decimal number be accurately stored in floating point representation? **[2 points]**

28) a. Cite an issue with string functions in C. **[2 points]**

b. Distinguish between *String* and *StringBuffer* classes in Java. **[2 points]**

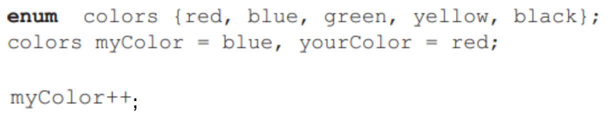
c. Give three types of strings according to string length and provide an example PL for each. **[3 points]**

29) a. Give the fields of a descriptor for a limited dynamic character string type. **[3 points]**

b. Give three approaches to supporting the dynamic allocation and deallocation that is required for dynamic length strings. **[3 points]**

30) Give three design issues for enumeration types. **[3 points]**

31) Given:



```
enum  colors {red, blue, green, yellow, black};
colors myColor = blue, yourColor = red;

myColor++;
```

a. What is the current value of *myColor*? **[2 points]**

b. In C++, is the statement *myColor* = *4;* legal? Explain. **[2 points]**

32) Name an advantage and disadvantage of enumeration types. **[2 points]**

33) How does representing array subscripts using parenthesis affect readability? **[1 point]**

34) There are four categories of arrays, based on the binding to subscript ranges, the binding to storage, and from where the storage is allocated. Give them and provide an advantage and a disadvantage for each. **[12 points]**

35) How can jagged arrays be supported in C? **[2 points]**

36) What are the fields of a Compile-time descriptor for single-dimensioned arrays? **[3 points]**

37) a. Differentiate a heterogeneous array from a record. **[3 points]**

b. Describe how records are implemented. **[3 points]**

38) Define fully qualified and elliptical references to fields in records. **[3 points]**

39) Give three characteristics of a tuple. **[3 points]**

40) a. What are the two types of unions? Discuss each briefly. **[3 points]**

b. How are unions implemented? **[2 points]**

41) Pointers are designed for two distinct kinds of uses. Discuss each. **[4 points]**

42) Give an example situation where the usage of pointers adds writability to a language. **[3 points]**

43) a. Discuss a scenario that creates (a) a dangling pointer, and (b) memory leakage. **[5 points]**

b. Give two solutions to the dangling pointer problem. **[4 points]**

44) Give two methods of garbage collection, then discuss the process of and identify an issue for each approach. **[6 points]**

45) Give an example of an optional type variable. **[2 points]**

46) In what way is static type checking better than dynamic type checking? **[2 points]**

47) What is strong typing and why is it important in a programming language? **[3 points]**

48) Why is Java not strongly typed? **[2 points]**

49) When can we say that two types are equivalent? **[2 points]**

50) a. What is the primary advantage of name type equivalence? **[2 points]**

b. What is the primary disadvantage to structure type equivalence? **[2 points]**