CS4080 Assignment 1 – Ryan Skinner

1. **Which category of C++ reference variables is always aliases?**
   Union
2. **What is the l-value of a variable? What is the r-value?**
   L-value: address of the variable
   R-value: value bound to that variable
3. **Define binding and binding time.**
   Binding is an association between an entity and an attribute. Binding time is when the binding occurs.
4. **After language design and implementation, what are the four times bindings can take place in a program?**
   1. Compile time
   2. Load time
   3. Run time
   4. Link time
5. **Define static binding and dynamic binding.**
   Static: binding before the run time and never changes
   Dynamic: Occurs during run time or changes during execution
6. **What are the advantages and disadvantages of implicit declarations?**
   Pro: writability
   Con: reliability
7. **What are the advantages and disadvantages of dynamic type binding?**
   Pro: flexibility
   Con: Cost and harder error detection
8. **Define static, stack-dynamic, explicit heap-dynamic, and implicit heap-dynamic variables. What are their advantages and disadvantages?**
   Static: bound before execution
      Pro: efficient
      Con: less flexibility
   Static-dynamic: memory is reserved statically but is bound when the statement is elaborated
      Pro: recursion, conserves storage
      Con: overhead, inefficient
   explicit heap-dynamic: allocated and deallocated by directives
      Pro: dynamic
      Con: inefficient and unreliable
   implicit heap-dynamic: allocated and deallocated by assignment
      Pro: flexibility
      Con: inefficient and less error detection
9. **Define lifetime, scope, static scope, and dynamic scope.**
   Lifetime: how long a variable is bound to a location
   Scope: range of visibility of the variables
   Static Scope: binding names to non-local variables
   Dynamic Scope: Scope based on subprograms, determined at run time
10. **What is the general problem with static scoping?**
    Too much access is allowed, slowly evolves program to be global instead of nested
11. **What is the referencing environment of a statement?**

All variables that are visible in the statement

12. **What is a static ancestor of a subprogram? What is a dynamic ancestor of a subprogram?**
    static: procedures where the subprogram is defined
    dynamic: procedures called before the subprogram

Programming Exercise 1:

All 3 programs say the variable is not able to be found

Programming Exercise 2:

Static avg in microseconds:	0.016538
Stack avg in microseconds:	0.764786
Heap avg in microseconds:	2.94339

Static is the fastest because it is bound before execution
Next fastest is stack because it is added to the bottom (top?) of the stack-dynamic
Heap is the slowest because it has to search for a space to allocate