

## Chapter 6 and 7 Homework

### CSCI-400 Spring 2013

1) What is meant by a “dangling pointer” and what options are available to the language designer to deal with it?

**(p292) A dangling pointer is one that does not point to a presently allocated memory address and generally results when the memory that a pointer points to is deallocated but the value of the pointer is not changed (preferably to NULL). The language designer can use techniques such as tombstones or locks and keys, but a better way is to restrict the ability of the programmer to set pointer values and manage them directly.**

2) What is a “memory leak” and what options are available to the language designer to deal with it?

**(p293) A memory leak occurs when no pointer is referencing a block of dynamically allocated memory but the memory has not been deallocated. This generally results when a pointer is reused without freeing the prior block that it pointed to. The language designer can address this issue by restricting the ability of the programmer to set pointer values and performing implicit deallocation (garbage collection) on blocks that are no longer referenced.**

3) What does it mean if the operands of an operator are of “compatible” types?

**(p302) An operand is compatible if its type is legal for use with that operator or if it can be implicitly coerced to a legal type.**

4) Describe the reference counter approach to garbage collection. What are the advantages and disadvantages? **(1pt each for description, one advantage, one disadvantage)**

**(p299) Each dynamically allocated block of memory contains a counter that tracks how many variables point to it. When the reference counter is zero, the block is garbage and can be collected. The advantage is that the overhead is incremental thus avoiding noticeable delays in execution. The disadvantages include the overall overhead associated with maintaining the counters, the potential for the counters to become a significant fraction of the memory allocated, and the possibility of a ring of blocks becoming lost.**

5) Describe the mark/sweep approach to garbage collection.

**(p300) Memory allocation and deallocation occur as if no garbage collection were to be done. At some point, such as when a memory allocation request cannot be honored, the system goes through a process in which all allocated memory cells are first marked as being garbage. Then all of the cells that are reachable from any pointer in the program are marked as still being in use. Finally, all of the cells that are still marked as being garbage are deallocated.**

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6) What is meant if a language is said to exhibit “guaranteed short circuiting”?

**(p335) When a Boolean expression is evaluated, the order of evaluation of the operands is specified (generally left then right) and the second operand is not evaluated if the value of the expression can be determined from the first operand alone.**

7) What is a “widening” conversion and what is a “narrowing” conversion?

**(p329) A widening conversion is one in which all values of the type being converted from have at least approximate values in the type being converted to. A narrowing conversion, on the other hand, cannot always convert values to reasonably close approximations.**

8) What are “functional side effects” and why do most languages permit them, despite the loss of referential transparency that typically results?

**(p325) A functional side effect is occurs when a function changes the value of one of its actual parameters, a nonlocal variable, or a static variable. Most languages permit them because without them the access efficiencies associated with global/static variables would be lost and state information would have to be passed to functions explicitly.**

9) In languages such as C, C++, Perl, and JavaScript, the assignment operation is also an expression. What does this mean and what are the advantages and disadvantages of it?

**(p339) The assignment operation evaluates to the value that was assigned to the target variable and thus an assignment expression can be used anywhere an expression resulting in the same result type can be used. This permits some code optimizations to occur but is another instance of a side effect that can reduce code readability and maintainability.**

10) What does it mean to “dereference” a pointer and under what conditions can doing so be unsafe, even if no write operation is being performed?

**(p291) When a pointer is dereferenced, its value is used as the address of another memory cell. If a pointer is dereferenced then the memory cell pointed to will be accessed, even if only to read the value presently stored there. If the pointer does not point to a valid memory cell for the program, then an error can occur.**

### SUBMISSION

Name your pdf file **CS400\_UserID\_HW\_nn** where **nn** is the homework number.

### GRADING RUBRIC – 40 pts

- 10 - Good Faith effort (1pt per problem).**
- 30 - Quality and Correctness (3pts per problem)**
- 10 - Improper submission.**