Code:

BS-CSE Program Outcomes Achievement Test (POCAT) (Autumn '16) (Group 1)

Background: POCAT was created in order to help assess the degree to which our majors achieve the various intended program outcomes of our program. Information about the performance of individual students on POCAT will not be collected or used in any way. *Please do not write your name anywhere on this test*. Note that each test paper has a unique code assigned to it that appears at the top right of this page. When results of the test are posted (in a few days), they will be organized by this code. If you want to know how you did on the test, you will have to remember the code that appeared on your test. If you forget your code, there is no way to later determine your score on the test.

The test: The topics that the questions in the test are based on are mostly from the required courses and the "core-choice" courses. But they are not the typical questions you might find in, say, the final exams of those courses. Instead, they are more conceptual and are intended to see how well students understand key concepts from across the curriculum and apply them in appropriate situations.

There are 20 questions on the test. Each is a multiple-choice question. Each question has, as one possible answer, something along the lines of "I have no idea". You should choose that if you really don't have any idea how to answer the question; if, on the other hand, you are not sure of the answer but can make an informed guess, please do so. For questions related to the core-choice courses, another possible answer is "I have not taken this course"; please choose that if you have not taken the course, *even if you happen to know the answer*. There are a couple of additional questions at the end that ask for your opinions about this test.

Further details about this test and how it will help us assess the programs and improve them appear in a set of web pages that can be accessed by following the *Exit Test*-link that appears in the BS-CSE page of the department's on-line Undergraduate Program Brochure.

Note: For each question, **circle** the *one* answer you think is most appropriate. Do not circle more than one.

1. A library has N books. Assigning unique identifiers to each book requires using n-bit labels. If the number of books is doubled, how many bits (per label) are now needed to form unique identifiers?
   (a) $n + 1$**this**
   (b) $n + 2$
   (c) $2n$
   (d) n^2
   (e) 2^n
   (f) None of the above
   (g) I have no idea.

2. Suppose you decide to represent a type to facilitate searching for "keys" (e.g., a set or map component) by using a hash table. All the statements below describe properties of a good hash function, except one. Which statement is *incorrect*?
   (a) The integer values that the hash function returns should be about uniformly distributed among all its possible return values.
   (b) The hash function should be computable rather efficiently; otherwise, you lose some of the speed advantage that hashing is supposed to give you.
   (c) The number of integer values that the hash function could possibly return must be equal to the number of buckets in the hash table. **this**
   (d) If the hash function is called with two different key values to be hashed, it may return exactly the same result for both.
   (e) If the hash function is called multiple times with exactly the same key value to be hashed, it must return exactly the same result each time.
   (f) I have no idea.

3. Your brother/sister is very ill and needs medication you cannot afford, so you steal it. Which of the following is the *ethical* question that arises in this scenario?
   (a) What kind of illness does your sibling have and how do we prevent its spread among populations?
   (b) Why is the medication not affordable and how do we make it more affordable?
   (c) Is it ever right to steal, even if you have a great need? **this**
   (d) What consequences might you face if you were caught stealing the medication?
   (e) *All* of the above are ethical questions.
   (f) All of the above are important but *none* of them is an ethical question.
   (g) I cannot decide based on the given information.

4. (Question based on CSE 3341) Large *C* and *C++* programs typically include header files whereas *Java* programs do not. This is because:
   (a) I have not taken CSE 3341
   (b) Large *C/C++* programs are difficult to understand and header files help with that understanding whereas *Java* programs are easy to understand so there is no need for header files;
   (c) *C/C++* compilers are one-pass and needs the header files whereas *Java* uses more than one pass; **this**
   (d) *Java* uses a new technology to create the header files it needs;
   (e) The claim is false; *Java* programs also use header files;
   (f) I have no idea.

5. Let $s1$ and $s2$ be finite mathematical sets of integers, and consider this assertion:

   $\exists x, y$: **integer**, a : **finite set of integer**

   $((s1 = \{x\} \cup a) \wedge (s2 = \{y\} \cup a))$

   Which one of the following pairs of values for $s1$ and $s2$ makes the assertion true?
   (a) $s1 = \{5, 6, 7\}, s2 = \{5, 6, 8\}$; **this**
   (b) $s1 = \{5, 6, 7\}, s2 = \{5, 8, 9\}$;
   (c) $s1 = \{1, 2, 8, 9\}, s2 = \{1, 2, 3\}$;
   (d) $s1 = \{4, 5, 6\}, s2 = \{4, 5, 6, 7, 8\}$;
   (e) More than one of the above;
   (f) None of the above;
   (g) I have no idea.

6. In technical writing, an accurate "audience profile" helps:
   (a) The reader focus on the relevant part(s) of the larger document;
   (b) The author write more effectively by tailoring the document to the intended set of readers; **this**
   (c) The author entertain the reader by appealing to humor relevant to the prospective reader;
   (d) The publisher identify who has acquired the document, and may include the means of this acquisition (e.g., purchase at traditional bookstore, purchase though the web, academic license, fair use copying);
   (e) The word processing software optimize various formatting and language checks;
   (f) I have no idea.

7. (Question based on CSE 3321)
   Let $L = \{s \mid s \in \{a, b\}^*$ does *not* contain the substring $ab\}$. A regular expression for L is:
   (a) I have not taken CSE 3321
   (b) $(a + b)^*$
   (c) a^*
   (d) $a^* + b^*$
   (e) b^*a^* **this**
   (f) I have no idea.

8. Recall that a *predicate* is a function that maps its argument(s) to {*true, false*}.

   Let x, y be two integer variables and $P(x, y)$ a predicate over them.
   Let A be the sentence $(\forall\, x)(\exists\, y)[P(x, y)]$
   Let B be the sentence $(\exists\, y)(\forall\, x)[P(x, y)]$

   Which of the following must be true?

   (a) $A \Rightarrow B$
   (b) $B \Rightarrow A$ **this**
   (c) Both (a) and (b) must hold.
   (d) Neither (a) nor (b) may hold.
   (e) I have no idea.

9. Consider the following Java method and method invocation.

```
public static void p(int x, int[] a) {
  x = x + 1;
  a[0] = 7;
}
...
int i = 3;
int[] array = new int[5];
array[0] = 9;
p(i, array);
System.out.println(i + "," + array[0]);
```

   What is printed to the screen?

   (a) 3,9
   (b) 4,9
   (c) 3,7 **this**
   (d) 4,7
   (e) Run-time exception
   (f) I have no idea

10. Two threads are running the following code:

```
(1) a = x;
(2) a = a + 1;
(3) x = a;
```

where `a` is a stack variable, `x` is a global variable initialized with 0. After these two threads finished execution of the lines (1) to (3), what would be the possible values of `x`?

(a) 2;
(b) 1;
(c) 1, 2; **this**
(d) None of the above;
(e) I have no idea.

11. Which of the following scheduling algorithms does *not* suffer starvation, i.e., indefinite blocking, problems? (assuming no job runs forever).

(a) First Come First Serve; **this**
(b) Non-preemptive Shortest Job First;
(c) Preemptive Shortest Job First;
(d) Priority Scheduling;
(e) While some of these algorithms are better in some respects than others, *all* of them have the potential for starvation.
(f) While some of these algorithms are worse in some respects than others, each of them will allow every job to ultimately proceed; i.e., *none* of them will lead to starvation.
(g) I have no idea.

12. (Question based on CSE 3421)
Recall the concept of instruction pipelining in which the data path for instruction execution is divided into separate stages. Which of the following statements about instruction pipelining is true?

(a) I have not taken CSE 3421.
(b) Instruction pipelining can reduce the time required to execute individual instructions.
(c) Instruction pipelining can increase the number of instructions executed in a fixed ammount of time. **this**
(d) Instruction pipelining can decrease the number instructions that load data from main memory.
(e) All of the above.
(f) None of the above.
(g) I have no idea.

13. If b is a Boolean variable, then the (*C++* or *Java*) statement "*b = (b == false);*" has what effect?
    (a) It causes a compile-time error message.
    (b) It causes a run-time error message.
    (c) It causes b to have value *false* regardless of its value just before the statement was executed.
    (d) It always changes the value of b. **this**
    (e) It changes the value of b if and only if b had value true just before the statement was executed.
    (f) I have no idea.

14. (Question based on CSE 3241)
    Consider the relational schema $R = (A, B, C, D)$, with the functional dependencies:

    $$\{A \to BCD, BC \to AD, B \to D, D \to B\},$$

    Recall that the notation $S1 \to S2$ where $S1, S2$ are two sets of attributes denotes that if we know the value of each attribute in $S1$ then we can determine the value of each attribute in $S2$.

    One of the keys for this schema is A. Which of the following is also a key?

    (a) I have not taken CSE 3241
    (b) *AB*;
    (c) *B*;
    (d) *D*;
    (e) *CD*; **this**
    (f) *BCD*;
    (g) I have no idea.

15. Consider the following program fragment:

```
sum = 0;
for (i=1; i<=n; i=i*2)
   for (j=1; j<=n; j++)
      sum = sum + 1;
```

    Which answer best describes the aymptotic running time (as a function of n) for this fragment?

    (a) $O(\lg n)$
    (b) $O(n)$
    (c) $O(n \lg n)$ **this**
    (d) $O(n\sqrt{n})$
    (e) $O(n^2)$
    (f) I have no idea.

16. Suppose $T(n)$ is the running time of an algorithm on input of size n.
Suppose $T(n)$ satisfies the following recurrence:

$$T(n) = \begin{cases} 1, & \text{if } n \leq 1 \\ T(n/2) + n, & \text{if } n > 1. \end{cases}$$

What is the asymptotic running time of the algorithm?

(a) $\Theta(n)$ **this**
(b) $\Theta(2^n)$
(c) $\Theta(n^2)$
(d) $\Theta(\lg n)$
(e) $\Theta(n!)$
(f) I have no idea.

17. Suppose $T(n) = 6n^2 log_2(n) + 7n^3 + 4n^2$
Which of the following is true?

(a) $T(n) \in \Theta(n^2 \log_2(n))$
(b) $T(n) \in O(n^{2.5})$
(c) $T(n) \in O(n^3 \log_2(n))$ **this**
(d) $T(n) \in \Omega(n^{3.5})$
(e) None of the above.
(f) I have no idea.

18. (Question based on CSE 3521) For the *A** search algorithm used in Artificial Intelligence, the "evaluation function" to rate and rank the goodness of a state/node in a search tree is defined as the:

(a) I have not taken CSE 3521
(b) cost from the initial state to the goal state;
(c) estimated cost from the current state to the goal state;
(d) true cost from the current state to the goal state;
(e) true cost from the initial state to current state, added to the estimated cost from the current state to the goal state; **this**
(f) estimated cost from the initial state to current state, added to true cost from the current state to the goal state;
(g) I have no idea.

19. (Question based on CSE 3232)
The Analysis phase of the SDLC discovers:

(a) I have not taken CSE 3232
(b) Who should do the analysis and what they should design;
(c) What the system should do, and not how the system will do it; **this**
(d) How the system should do things and what the users will need to do for it;
(e) What the system should do, and how the system should do it;
(f) All of the above;
(g) I have no idea;

20. (Question based on CSE 4471)
XOR encryption is applied to the following input to produce the following output.
The key is less than 9 bits long.

```
    Input: 110001101111010100001111110011111110110100001
   Output: 011111000001111010100001011101010011000110 11
```

```
Hint: XOR works as follows:
        Bit 1   Bit 2   XOR result
          0       0       0
          0       1       1
          1       0       1
          1       1       0
```

Which of the following is the encryption key?

(a) I have not taken CSE 4471
(b) 1010110
(c) 1011101
(d) 101110 **this**
(e) 0100010
(f) 010001
(g) Not enough information to determine;
(h) I have no idea.

21. The remaining questions are about this test. First, think about the *length* (not the difficulty, just the length) of the test. Would you say that it was:

(a) Too long;
(b) Too short;
(c) Just right!

22. In terms of *difficulty* of the test, would you say this test was:

(a) Too difficult;
(b) Too easy;
(c) Just right!