Soft Eng 3M04
Mid-Term I 2002
Dr. Jacques Carette

Name: _____

Student No.: _____

- This midterm contains 17 questions on three double-sided pages (including this one).

- This midterm will be marked out of 50. There are 55 total marks available.

- Answer the question in the space provided.

- Make sure that your name is on all sheets.

- Do not separate the pages.

- Make sure that you do not get stuck on one question; use your time wisely.

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1. This course is about being able to put a _____ on software. *[1]*

2. Define "Software Engineering". Contrast this with Computer Science. (2-3 short sentences) *[3]*

3. Define COTS. Give an example. *[2]*

4. Explain what "Building software that <u>solves the right problem</u>" means. (3-4 short sentences). *[3]*

5. Define "Software Aging". What are its main causes? (3-4 short sentences). *[3]*

6. What are the likely consequences of having no specifications or only informal specifications? (4-5 short sentences) *[4]*

7. What is the purpose of a prototype? (1-2 short sentences) *[2]*

8. Which one of these is **not** a goal of this course? [underline]
   To learn how to develop (large) software products that

   (a) reliable
   (b) easily maintained
   (c) efficient
   (d) can be verified

   [1]

9. Given alphabet $\Gamma = \{a, b\}$ and BNF grammar $(a|b)?(bab|aba)^+a^*b^*$, indicate using *true* or *false* if the following strings are in the language defined that grammar.

   (a) bab
   (b) babbab
   (c) bababa
   (d) aaa
   (e) bbabb
   (f) ababab
   (g) abbabaaabb

   [7]

10. Over the alphabet $\Gamma = \{a, b, c\}$, give the BNF grammar which defines the language which contains the set of all strings that must contain the substring **abacab**. [3]

11. The type $`a \rightarrow `b \rightarrow `c$ has 2 interpretations. Using words, describe both. [3]

12. Write out in words what $(('a \rightarrow `b) \times ('a \rightarrow `b))$ *seq* means. [3]

13. Write the formal type for the function *select* which takes a tuple containing of function of type 'a to type bool and a sequence of type 'a and returns a sequence of type 'a. [2]

14. Define currying. Give the formal type of the curried version of *select* defined in the previous question. *[3]*

15. Given the following signature and variable declaration

```
signature TOTO =
    sig
    val a1 : 'a
    val a2 : 'a -> bool
    val a3 : 'b -> ('a seq)
    val a4 : int -> 'a
end
val a5 : int
val a6 : bool
```

are the following valid expressions (valid/invalid)?

(a) a2

(b) λa5:int.a2(a5)

(c) λa1:char.a2(a1)

(d) a3(a2(a4(-3)))

(e) S x:int.a2(x)

[5]

16. Given the signature and declarations from the previous question, which of the following are valid formulas (use valid/invalid).

(a) a2

(b) $\forall$a5:int.a2(a5)

(c) a6 and true

(d) $\exists$x:int.a2(a4(x))

(e) $\neg(a1)$

[5]

4

17. Write a complete MIS for the (stateless) module that provides 3 functions for the addition, multiplication and negation of arbitrary length integers (external type INT). Arbitrary length means that they can never overflow. *[5]*