6.045J/18.400J: Automata, Computability and Complexity	Prof. Ron Rivest

Handout 3: Quiz 2 Information

5 Wednesday 2003	*Matthew Lepinski*

1 General Information on Quiz 2

Quiz 2 will take place during class on Wednesday, April 2. The Quiz will cover chapters 4 and 5 of Sipser's Text, as well as Section 6.1 and the supplementary material on Counter Machines and Rice's Theorem. You are encouraged to bring a two-sided sheet of handwritten notes with you to class on Wednesday to use during the quiz. You should bring your copy of Sipser's Text with you to class on Wednesday to use during the quiz. (You are also allowed to use the handout on Counter Machines from the Hopcroft text and the handout on Rice's theorem from the Kozen text).

2 Material You Should Know for the Quiz

The following is a list of important topics and ideas we covered during the Computability portion of this class.

- **Turing Machines and the Church-Turing Thesis**. You should know the formal definition of a Turing Machine and understand the way that a Turing Machine computes on a given input. Additionally, you should understand the Church-Turing thesis and be comfortable with using one model of computation to simulate another model of computation. (Multi-tape Turing Machines, Non-deterministic Turing Machines, etc)

- **Recognizability and Decidability**. You should be able to define both Recognizability and Decidability. Additionally, you should understand the difference between the two concepts and be able to give examples of both recognizable and decidable languages.

- **Enumeration**. You should be comfortable with enumerators and should know what it means for a language to be enumerable. Additionally, you should understand why being recognizable is equivalent to being enumerable.

- **Undecidability**. You should know what it means for a language to be undecidable and you should understand why the Halting Problem is undecidable. Additionally, you should know several other languages which are undecidable and you should be comfortable with techniques for proving that a language is undecidable.

- **Mapping Reducibility**. You should understand the formal definition of mapping reducibility as well as the intuition behind this definition. You should be able to use mapping reducibility as a tool for showing languages are either decidable or undecidable.

- **PCPs and Counter Machines**. You should be comfortable with the definition of the Post Correspondence Problem and with Counter Machines. You should know that the PCP is undecidable as are several problems related to counter machines. You should understand the general techniques used for showing these problems are undecidable but you are not expected to be able to reproduce such proofs on a quiz.

- **Rice's Theorem**. You should know the statement of Rice's Theorem and understand when it applies and when it does not apply. You should be able to use Rice's Theorem to show problems are undecidable. You should understand the technique used to prove Rice's Theorem.

- **Recursion Theorem**. You should know the statement of the Recursion Theorem and understand how it is used. You should be familiar with the applications of the Recursion theorem which we discussed in class.