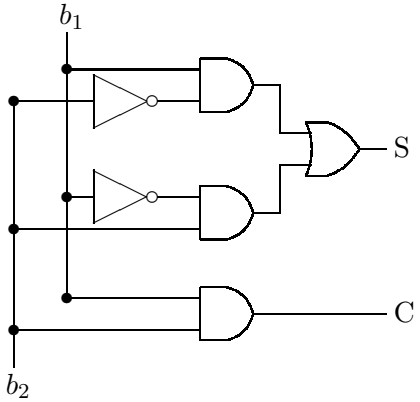
Review of the first 9 lectures

The first part of the exam will be closed book, no notes, and no computer.
The material breaks down in two parts:

1. computer science concepts: algorithms, computer architecture, functionality of operating systems, mass storage, formal languages, flowcharts and pseudocode, logic gates, transistors and flip flops, adder circuits, functional programming.
2. mathematical CS: binary and hexadecimal representations of numbers, precision and accuracy, boolean algebra, truth tables, simulation and Monte Carlo, histograms.

This sheet contains some preliminary examples of questions which may help you prepare for the first part of the midterm exam.

1. List the characteristics of an algorithm.
2. How many bytes are 15 terabytes?
3. Explain the difference between 34/87 and 34.0/87.
4. What is an interrupt?
5. Describe the differences between a compiler and an interpreter.
   What are the advantages/disadvantages of using a compiler and an interpreter?
6. Convert 318 into hexadecimal notation.
7. Rank all memory elements we have seen twice:
   (a) use once its speed (memory that is fastest to access comes first); and
   (b) use once its capacity (memory that is largest in size comes first).
8. What is the kernel of an operating system?
9. Consider the circuit shown below. For $b_1 = 1$ and $b_2 = 0$ as input, indicate on the picture below the input and output for every logical gate.



10. Draw the flowchart for the algorithm to search for the maximum in a list of unsorted numbers.
    Write pseudo code for this algorithm as well.

11. An exclusive or, denoted as XOR returns False only when the inputs are both the same, and True otherwise.

    (a) Give the truth table for the exclusive or.
    (b) Show how the XOR can be realized with NOT, OR, and AND by giving the logical expressions and their corresponding truth tables.
    (c) Draw the circuit for the XOR, using the symbols for the gates NOT, OR, and AND.

12. Use truth tables to verify that

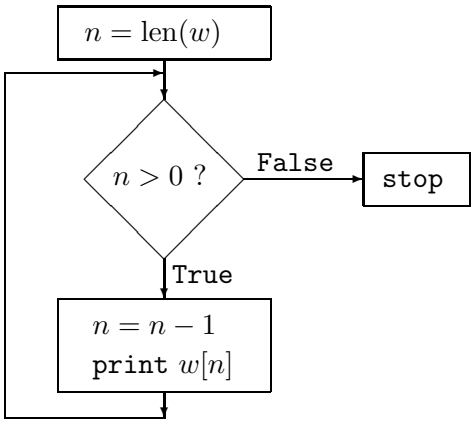
    $$((\text{NOT } A) \text{ AND } B \text{ AND } C) \text{ OR } (A \text{ AND } (\text{NOT } B) \text{ AND } C) \\ \text{OR } (A \text{ AND } B \text{ AND } (\text{NOT } C)) \text{ OR } (A \text{ AND } B \text{ AND } C)$$

    is equivalent to

    $$(A \text{ AND } B) \text{ OR } (B \text{ AND } C) \text{ OR } (A \text{ AND } C).$$

    Draw a realization of the second expression using the diagrams for the logic gates.

13. Consider the flowchart, that takes on input the word w:



    (a) Explain what the algorithm defined by the flowchart does, that is: write pseudo code.
    (b) Redraw the flowchart that swaps the test with the body of the loop.

14. Describe the top down functional design for a program that takes orders in a fastfood restaurant. The program should display a menu, prompt the customer to make a selection, calculate the price of the order, and then finally ask the customer to confirm the order. Draw a hierarchy of the functions and for every function write a least one line for documentation string.

The policy on skipping exam holds: If an exam is missed, then greater weight will be placed on the final exam, especially on the material covered on the missing exam. **What this means is** that if you decide not to take one midterm exam, your final exam will be weighted for one hundred points more. **What it does NOT mean is** that you can drop the score of a midterm exam. If you take the midterm, then your score counts. So, please be prepared when you show up for the exam.