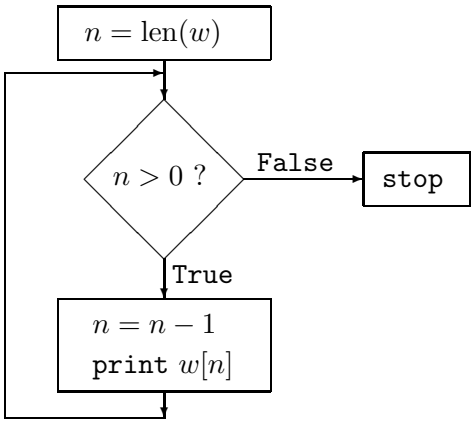
Review of the first 9 lectures

The second part of the exam will be open notes, books, and with a computer.
The material in this part has its focus on Python:

1. variables and assignments, elementary and composite types, intrinsic operations, tuples, lists, dictionaries, anydbm, queues and stacks;
2. if else elif, while and for, queues and stacks, top down design, functions, lambda, list comprehensions.

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

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



   (a) Write Python code based using the same control logic as shown in the flowchart.

   (b) The flowchart suggests a repeat-until construction.
   Write Python code that uses a for loop.

2. Consider the following pseudocode:

```
input: x, a floating point number;
       c, a list of coefficients.
output: c[0] + c[1]*x + c[2]*x**2 + .. + c[n]*x**n,
        where n = len(c) - 1.
result = c[0]; i = 0; n = len(c); p = x
as long as i < n-1 do
     result = result + c[i+1]*p
     p = p * x; i = i + 1
output result
```

   Write a Python script that implements this pseudocode.

3. What data structure of Python would you use to store the derivatives of trigonometric expressions like cos, sin, and tan? Illustrate with actual Python code.

4. Give the Python code to generate a list of all tuples containing all possible input values for a Boolean expression, i.e.: [(False,False),(False,True),(True,False),(True,True)].
   Extend the code so it will work for triplets.

5. Write a program to sum the values of coins. The coins are represented by a sequence of characters, like `pnqdpqnnppdqddpp`, where `p`, `n`, `d`, `q` represent respectively a penny ($0.01), nickel ($0.05), dime ($0.10), and quarter ($0.25). Use a dictionary.

6. Give Python code to convert strings like `"34 dollar"` and `"1.23 dollar"`
   into `"$34"` and `"$1.23"`. The number in front of the `dollar` can be of any size.

7. Consider the following game. The computer generates a random natural number between 1 and 9. This number is the secret. The user is allowed to make three guesses for the secret. Write Python code to implement this game.

8. To test whether `random.uniform(0,1)` generates numbers uniformly distributed in $[0, 1]$, we generate 1000 samples and build a histogram, counting how many numbers are in the four equal subintervals of $[0, 1]$. Write Python code to perform this test.

9. Explain how to simulate an unfair coin that when flipped returns head with probability 0.6. Give a Python function for such unfair coin.

10. Define a Python function that returns as a tuple the roots of a polynomial $p(x) = ax^2 + bx + c$, using $\frac{-b \pm \sqrt{b^2-4ac}}{2a}$. Write the function so that 1 is the default value for a.

11. A trigonometric function like $A\sin(k2\pi t)$ has amplitude A and frequency k (number of cycles per time unit). Write a Python function `f` to evaluate $A\sin(k2\pi t)$ at t (the first argument of `f`) where default values for A and k are both one. If the last optional argument of f takes the value `nopi`, then the function will return the value $A\sin(kt)$ instead.

12. Give Python code to create a list of the first 20 natural numbers, raised to the power 3.
    Do it once with `for` and once without using any `for` or `while` loops,
    but do it with list comprehensions.

13. Use list comprehensions to make `L = [[('a', 97), ('b', 98), ..., ('z', 122)]`.
    The list of tuples `L` links the lower case letters `a` to `z` to their respective ASCII codes.

14. Write a Python program that doubles the spaces in a file: every space in the input file is replaced by two consecutive spaces in the output file.

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.