DATA C88C Summer 2025

Control, Environment Diagrams

Discussion 2: June 25, 2025

While and If

Learning to use **if** and **while** is an essential skill. During this discussion, focus on what we've studied in the first three lectures: **if**, **while**, assignment (=), comparison (<, >, ==, ...), and arithmetic. Please don't use features of Python that we haven't discussed in class yet, such as **for**, **range**, and lists. We'll have plenty of time for those later in the course, but now is the time to practice the use of **if** (textbook section 1.5.4) and **while** (textbook section 1.5.5).

Q1: Fizzbuzz

Implement the classic *Fizz Buzz* sequence. The **fizzbuzz** function takes a positive integer **n** and prints out a *single line* for each integer from 1 to **n**. For each **i**:

- If i is divisible by both 3 and 5, print fizzbuzz.
- If i is divisible by 3 (but not 5), print fizz.
- If i is divisible by 5 (but not 3), print buzz.
- Otherwise, print the number i.

Try to make your implementation of fizzbuzz concise.

```
def fizzbuzz(n):
    >>> result = fizzbuzz(16)
   fizz
   buzz
   fizz
    7
   fizz
   buzz
    11
   fizz
   13
    14
    fizzbuzz
    16
    >>> print(result)
    None
    0.00
    i = 1
    while i <= n:</pre>
        if i % 3 == 0 and i % 5 == 0:
            print('fizzbuzz')
        elif i % 3 == 0:
            print('fizz')
        elif i % 5 == 0:
            print('buzz')
        else:
            print(i)
        i += 1
```

Video walkthrough

Problem Solving

A useful approach to implementing a function is to: 1. Pick an example input and corresponding output. 2. Describe a process (in English) that computes the output from the input using simple steps. 3. Figure out what additional names you'll need to carry out this process. 4. Implement the process in code using those additional names. 5. Determine whether the implementation really works on your original example. 6. Determine whether the implementation really works on other examples. (If not, you might need to revise step 2.)

Importantly, this approach doesn't go straight from reading a question to writing code.

For example, in the is_prime problem below, you could: 1. Pick n is 9 as the input and False as the output. 2. Here's a process: Check that 9 (n) is not a multiple of any integers between 1 and 9 (n). 3. Introduce i to represent each number between 1 and 9 (n). 4. Implement is_prime (you get to do this part with your group). 5. Check that is_prime(9) will return False by thinking through the execution of the code. 6. Check that is_prime(3) will return True and is_prime(1) will return False.

Try this approach together on the next two problems.

Important: It's highly recommended that you **don't** check your work using a computer right away. Instead, talk to people around you and think to try to figure out if an answer is correct. On exams, you won't be able to guess and check because you won't have a Python interpreter. Now is a great time to practice checking your work by thinking through examples. You could even draw an environment diagram!

If you're not sure about how something works or get stuck, ask for help from the course staff.

Q2: Is Prime?

Write a function that returns True if a positive integer n is a prime number and False otherwise.

A prime number n is a number that is not divisible by any numbers other than 1 and n itself. For example, 13 is prime, since it is only divisible by 1 and 13, but 14 is not, since it is divisible by 1, 2, 7, and 14.

Use the % operator: x % y returns the remainder of x when divided by y.

```
def is_prime(n):
    0.00
    >>> is_prime(10)
    False
    >>> is_prime(7)
    True
    >>> is_prime(1) # one is not a prime number!!
    False
    0.00
    if n == 1:
        return False
    k = 2
    while k < n:
        if n % k == 0:
            return False
        k += 1
    return True
```

Q3: Unique Digits

Write a function that returns the number of unique digits in a positive integer.

Hints: You can use // and % to separate a positive integer into its one's digit and the rest of its digits.

You may find it helpful to first define a function has_digit(n, k), which determines whether a number n has digit k.

```
def unique_digits(n):
    """Return the number of unique digits in positive integer n.
    >>> unique_digits(8675309) # All are unique
    7
    >>> unique_digits(13173131) # 1, 3, and 7
    >>> unique_digits(101) # 0 and 1
    11 11 11
    unique = 0
    while n > 0:
        last = n % 10
        n = n // 10
        if not has_digit(n, last):
            unique += 1
    return unique
# Alternate solution
def unique_digits_alt(n):
    unique = 0
    i = 0
    while i < 10:
        if has_digit(n, i):
            unique += 1
        i += 1
    return unique
def has_digit(n, k):
    """Returns whether k is a digit in n.
    >>> has_digit(10, 1)
    True
    >>> has_digit(12, 7)
    False
    assert k \ge 0 and k < 10
    while n > 0:
        last = n % 10
        n = n // 10
        if last == k:
            return True
    return False
```

We have provided two solutions: - In one solution, we look at the current digit, and check if the rest of the number contains that digit or not. We only say it's unique if the digit doesn't exist in the rest. We do this for every digit. -

6 Control, Environment Diagrams
In the other, we loop through the numbers 0-9 and just call has_digit on each one. If it returns true then we know the entire number contains that digit and we can one to our unique count.