

CSE 250 Recitation

January 30 - 31: Welcome, Summations, Linked Lists

Welcome

Introductions

- SAs: Who are we?
- Class: Who are you?

Participation

- Written exercises during recitation
- Not about getting it right...it's about gaining hands on experience*
- Good opportunity to ask questions
- **Turned in with your name and UBIT for attendance** (see syllabus)

* we reserve the right to not count participation with no effort

Summations – General Form

$$\sum_{i=j}^k f(i) = f(j) + f(j+1) + \dots + f(k)$$

Summations - Examples

k is 7

$\sum_{i=4}^7 5i = 20 + 25 + 30 + 35$

f(i) is 5i

j is 4

f(4) f(5) f(6) f(7)

The diagram illustrates the summation $\sum_{i=4}^7 5i$. The upper limit 7, the term 5i, and the lower limit 4 are circled in red. The summation is expanded as $20 + 25 + 30 + 35$. Arrows point from these terms to labels f(4), f(5), f(6), and f(7) respectively, indicating that f(i) = 5i.

Summations - Examples

$\sum_{i=n}^{n^2} 15n \cdot i = 15n^2 + 15n \cdot (n+1) + \dots + 15n^3$

n^2 is n^2 $f(i)$ is $15n \cdot i$

$i=n$ is n

$f(n)$ $f(n+1)$ $f(n^2)$

The diagram illustrates a summation with variable bounds. The upper bound n^2 and lower bound $i=n$ are circled in red. The term being summed, $15n \cdot i$, is also circled in red. The expansion shows the first, second, and last terms of the series. Arrows indicate that $f(n)$ corresponds to the first term $15n^2$, $f(n+1)$ corresponds to the second term $15n \cdot (n+1)$, and $f(n^2)$ corresponds to the last term $15n^3$.

The bounds of our summation
can be unknowns!

Simplifying the Summation

$$\sum_{i=1}^{n^2} 15n \cdot i$$

Identify the parts of this summation
are **constant with respect to the
summation variable**

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Identify the parts of this summation are **constant with respect to the summation variable**

(notice how on the previous slide each term had a $15n$ that did not change...only the value of i did)

Simplifying the Summation

$$\sum_{i=n}^{n^2} 15n \cdot i$$

Which of S1, S8, or S9 does this most resemble?

$$\text{S1. } \sum_{i=j}^k c = \dots$$

$$\text{S8. } \sum_{i=1}^k i = \dots$$

$$\text{S9. } \sum_{i=0}^k 2^i = \dots$$

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Simplifying the Summation

$$\sum_{i=n}^{n^2} 15n \cdot i$$

What parts of the summation don't match the rule?

$$\text{S8. } \sum_{i=1}^k i = \dots$$

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$$\sum_{i=n}^{n^2} 15n \cdot i$$

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$$\text{S8. } \sum_{i=1}^k i = \dots$$

Notice how the lower bound in S8 is NOT an unknown...it must be exactly 1 to match

Recitation Exercise

Simplify the summation to its closed form solution using rules on the next slide

$$\sum_{i=n}^{n^2} 15n \cdot i$$

Summation Rules

$$\text{S1. } \sum_{i=j}^k c = (k - j + 1)c$$

$$\text{S2. } \sum_{i=j}^k (cf(i)) = c \sum_{i=j}^k f(i)$$

$$\text{S3. } \sum_{i=j}^k (f(i) + g(i)) = \left(\sum_{i=j}^k f(i) \right) + \left(\sum_{i=j}^k g(i) \right)$$

$$\text{S4. } \sum_{i=j}^k (f(i)) = \left(\sum_{i=\ell}^k (f(i)) \right) - \left(\sum_{i=\ell}^{j-1} (f(i)) \right) \quad (\text{for any } \ell < j)$$

$$\text{S5. } \sum_{i=j}^k f(i) = f(j) + f(j+1) + \dots + f(k-1) + f(k)$$

$$\text{S6. } \sum_{i=j}^k f(i) = f(j) + \dots + f(\ell-1) + \left(\sum_{i=\ell}^k f(i) \right) \quad (\text{for any } j < \ell \leq k)$$

$$\text{S7. } \sum_{i=j}^k f(i) = \left(\sum_{i=j}^{\ell} f(i) \right) + f(\ell+1) + \dots + f(k) \quad (\text{for any } j \leq \ell < k)$$

$$\text{S8. } \sum_{i=1}^k i = \frac{k(k+1)}{2}$$

$$\text{S9. } \sum_{i=0}^k 2^i = 2^{k+1} - 1$$

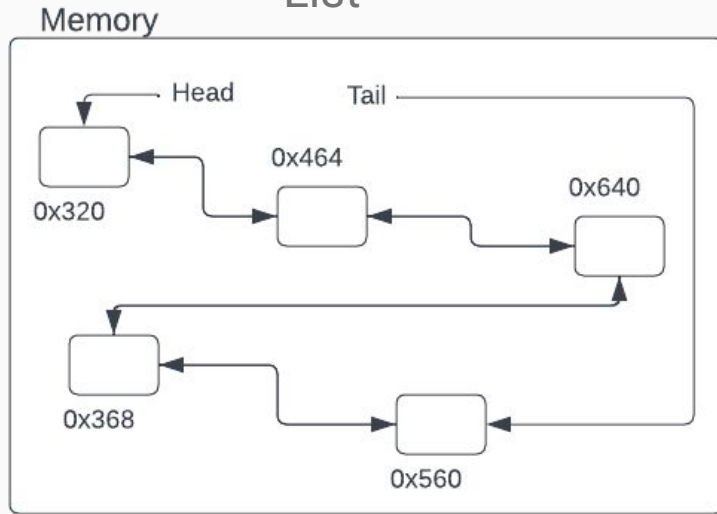
$$\sum_{i=n}^{n^2} 15n \cdot i$$

"Bonus" Question

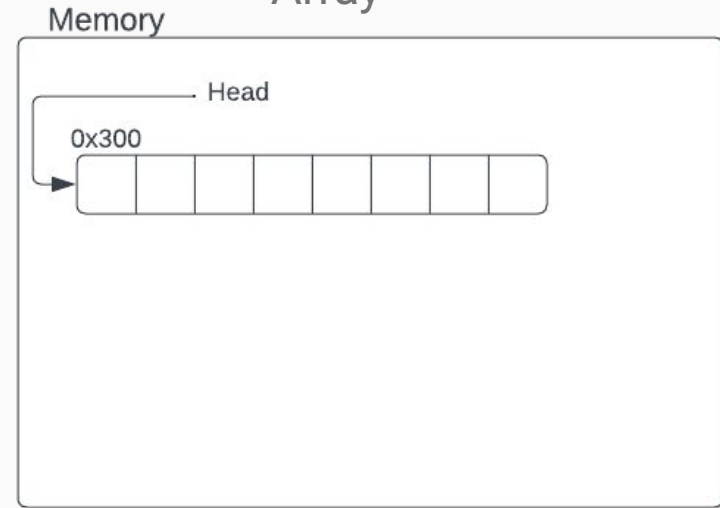
$$\sum_{x=0}^n \sum_{y=1}^k (x + 1)$$

Linked Lists vs. Arrays

List



Array



Recitation Exercise

Write out **pseudocode** for the following two algorithms:

1. Find the value of a linked list node at a given index
2. Find the index of a linked list node with a given value (return -1 if the value does not exist)

Be Precise!

If you write good pseudocode, translating it into Java (or C, or Python, or Scala, etc) should be straightforward!