CSCI 136: Data Structures and Advanced Programming
Lecture 22
Even more iterators / trees
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Topics

• Talent
• Bliterator
• Trees

Your to-dos

1. Read **before Mon**: Bailey, Ch 14.4
2. Lab 7 (partner lab), **due Tuesday 10/8 by 10pm**.
Think of someone you know who is talented.

Were they born with better abilities than you?

No universal, reliable measure of innate ability.

The relation of IQ to exceptional performance is rather weak in many domains, including music (Shuter-Dyson, 1982) and chess (Doll & Mayr, 1987).

For scientists, engineers, and medical doctors that complete the required education and training, the correlations between ability measures and occupational success are only around 0.2, accounting for only 4% of the variance (Band, 1983).

In a review of more than one hundred studies, Ghiselli (1966) found the average correlation between success-on-the-job measuring and aptitude-test scores to be 0.19.

In summary, the search for stable heritable characteristics that could predict or at least account for the superior performance of eminent individuals has been impressingly unsuccessful.

Takeaway: “innate ability” is probably a myth.

Despite years (>100) of effort, scientists have never identified a universal, reliable measure of innate ability.

What factor does matter? Practice.

Binet (Varon, 1935) started out using tests of basic perceptual and cognitive capacities to measure IQ, but found large practice effects, which were later documented by Gibson (1969).
But mere repetition is not enough.

Bryan and Harter (1897, 1899) identified plateaus in skill acquisition, when for long periods subjects seemed unable to attain further improvements.

With mere repetition, improvement of performance was often arrested at less than maximal levels, and further improvement required effortful reorganization of the skill.

Keller (1958) later showed that these plateaus were not an inevitable characteristic of skill acquisition, but could be avoided by different and better training methods.

Study tip #3

Experts practice deliberately.

We view elite performance as the product of maximal efforts to improve performance in a domain through an optimal distribution of deliberate practice. This view provides us with unique insights into the potential for and limits to modifying the human body and mind. Many characteristics, traditionally believed to be fixed, can adapt and change in response to intense practice sustained for years.

Deliberate practice is purposeful and systematic practice requiring focused attention and is conducted with the specific goal of improving performance.

Deliberate practice is exhausting.

Study tip #3

How does one sustain deliberate practice?

Our empirical studies show that experts carefully schedule deliberate practice and limit its duration to avoid exhaustion and burnout.

The learning algorithm:

1. **Start early.**
2. **Focus** solely on learning task. (i.e., no Instagram)
3. **Stop** after some time period. (~1 hr)
4. **Repeat** later. (e.g., the next day)

A bit iterator

Suppose we want to do the following:

On each iteration, get the **next most significant bit**, starting initially with the **least significant bit**.

**Bi**terator to the rescue.
Trees

Information is often **hierarchical**.

Trees facilitate **encoding** such information on a computer.
Recall: List ADT

A list is a recursive data structure that stores information sequentially. A list is either:

- **empty** (i.e., ∅) or
- a node containing a value and a reference to a list.

The empty list: ∅

List of length 1: [a ∅]

List of length 3: [a b c ∅]

Tree ADT

A tree is a recursive data structure that stores information hierarchically. A tree is either:

- **empty** (i.e., ∅), or
- a node containing a value and references to one or more trees.

The empty tree:

A non-empty binary tree:

```
       b
      / \
     a   c
    /\  /\  /\  \
  2 4 2 4 2 4
```
How is a tree defined?
(code)
Recap & Next Class

**Today:**
- Talent
- Bitrator
- Tree ADT

**Next class:**
- Terminology
- Implementation