Four Patterns

We've now seen four common patterns in parallel code

1. Map
2. Reduce
3. Prefix
4. Pack (a.k.a. Filter)

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Amdahl's Law

Suppose our program takes 100 seconds.
And S is 1/3 (i.e. 33 seconds).

What is the running time with
3 processors
6 processors
22 processors
67 processors
1,000,000 processors (approximately).

Amdahl's Law

$$\frac{T_1}{T_P} \leq \frac{1}{S + \frac{1-S}{P}}$$

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Bad Interleaving

```
void withdraw(int amount){
  int b = getBalance();
  if(amount > b)
  throw new …;
  setBalance(b-amount);
}
```

```
void withdraw(int amount){
  int b = getBalance();
  if(amount > b)
  throw new …;
  setBalance(b-amount);
}
```

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Bad Interleaving

There's still a bad interleaving. Find one.

```
void withdraw(int amount){
  int b = getBalance();
  if(amount > getBalance())
  throw new …;
  setBalance(
    getBalance()-amount);
}
```

```
void withdraw(int amount){
  int b = getBalance();
  if(amount > getBalance())
  throw new …;
  setBalance(
    getBalance()-amount);
}
```

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