

Worksheet: Futures

Here is a recursive, sequential divide-and-conquer function for finding a maximum value in an array:

```
static int findMax(int[] X, int lo, int hi) {  
    if ( lo > hi ) return 0;  
    else if ( lo == hi ) return X[lo];  
    else {  
        int mid = (lo+hi)/2;  
        var max1 =  
            findMax(X, lo, mid);  
        var max2 =  
            findMax(X, mid+1, hi);  
  
        return (max1 > max2)? max1 : max2;  
    }  
} // findMax
```

Indicate in the code the changes you need to make to this function in order to create a parallel, recursive divide-and-conquer function for finding a maximum value in an array. Are there any `Future.get()` operations that are guaranteed to be non-blocking?



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Here is a recursive, sequential divide-and-conquer function for finding a maximum value in an array:

```
static int findMax(int[] X, int lo, int hi) throws SuspendableException {
    if ( lo > hi ) return 0;
    else if ( lo == hi ) return X[lo];
    else {
        int mid = (lo+hi)/2;
        var max1 = future() ->
            findMax(X, lo, mid);
        var max2 = future() ->
            findMax(X, mid+1, hi);
        // Parent now waits for the future values
        return (max1.get() > max2.get())? max1.get() : max2.get();
    }
} // findMax
```

Indicate in the code the changes you need to make to this function in order to create a parallel, recursive divide-and-conquer function for finding a maximum value in an array. Are there any `Future.get()` operations that are guaranteed to be non-blocking?

Yes, the second `max1.get()` and `max2.get()`.



Futures should be effectively final

1. `var f1 = null;`
2. `var f2 = null;`
3. `f1 = future() -> { while (f2 == null); return f2.get(); }`
4. `f2 = future() -> { while (f1 == null); return f1.get(); }`

Deadlock if possible!



Futures should be effectively final

1. `var f1 = future() -> { while (f2 == null); return f2.get(); }`
2. `var f2 = future() -> { while (f1 == null); return f1.get(); }`

Why doesn't this produce a deadlock?

Compilation error!

