

**Goal** Implement register allocation based on graph coloring.

### Download the Project Tests

Download and unzip the tests [🔗](#) for this project under `$j/j--`.

Run the following command inside the `$j/j--` directory to compile the `j--` compiler with your changes:

```
>_ ~/workspace/j--  
$ ant
```

To compile a `j--` program `P.java` for the MIPS target, using register allocation based on “graph coloring”, run the following command:

```
>_ ~/workspace/j--  
$ bash ./bin/j-- -s graph P.java
```

Use the `-r <num>` argument to specify the number of physical registers available for allocation. The default value is 8.

Run the following command to run the MIPS program `P.s`:

```
>_ ~/workspace/j--  
$ spim -f P.s
```

**Problem 1.** (*Register Allocation*) Modify the file `$j/j--/src/jminusminus/NGraphRegisterAllocator.java` to implement register allocation algorithm based on graph coloring.

Directions:

- Build liveness intervals.
- Use the liveness intervals to build an interference graph  $G$ .
- Apply “degree  $< r$ ” heuristic to determine if  $G$  is  $r$ -colorable, where  $r$  is the number of physical registers available.
- If  $G$  is  $r$ -colorable, allocate physical registers to the virtual registers — there’s no need to generate spill instructions.
- If  $G$  is *not*  $r$ -colorable, allocate physical registers to the virtual registers, generating spill instructions as needed.

```
>_ ~/workspace/j--  
$ $j/j--/bin/j-- -s graph -r 3 project6/Factorial.java  
$ spim -f Factorial.s  
SPIM Version 8.0 of January 8, 2010  
Copyright 1990-2010, James R. Larus.  
All Rights Reserved.  
See the file README for a full copyright notice.  
Loaded: /usr/lib/spim/exceptions.s  
5040  
5040
```

Before you submit your files, make sure:

- Your code is adequately commented and follows good programming principles.
- You use the template file `report.txt` for your report.
- Your report meets the prescribed guidelines.

### Files to submit:

1. `NGraphRegisterAllocator.java`
2. `report.txt`