

Final exam times:

- Section 2 (12:00-13:15) has its final on Friday, May 19, 9:45-12:00
- Section 8 (19:00-20:15) has its final on Wednesday, May 24, 19:45-22:00

I will hold office hours during regular class times (but in my office) on Wednesday, May 17. Any topics covered in class, on the homework, or in the handouts may be covered, including those not on the sample test. This handout gives some practice problems for the material covered after the second midterm, but the final covers everything from the course. The test will be slightly weighted to focus more on the last third of the class, but all topics are fair game.

This review only covers items not on the first two midterm review sheets, so you should also review the first two midterms and the first two practice midterms. The final may cover material from any of the handouts, as well as anything covered in class. Here is a list of topics covered since the second midterm, or some topics on from the second midterm that didn't make it to that review sheet (no guarantee that this list is complete). **Program Proofs:** via Loop Invariants, **All Pairs Shortest Paths:** Floyd-Warshall, **Dynamic Programs:** $3N+1$ problem, Floyd-Warshall, **Nondeterminism:** hardness, completeness, and reductions.

Important: Remember how points are given. If you do not try a problem, or if you mark it for non-grading, you will get 30% for that problem. You can take this option for up to half of the test.

1. You are running the Floyd-Warshall all-pairs shortest paths algorithm on a graph with vertices $V = \{1, 2, 3, 4, 5\}$. You have the following for D^0 :

D^0	1	2	3	4	5
1	0	4	-5	6	∞
2	3	0	2	∞	∞
3	∞	∞	0	5	∞
4	∞	∞	∞	0	2
5	∞	∞	2	∞	0

- (a) Draw G .
- (b) Give D^5 .

2. What does the following piece of code return? Prove it using a loop invariant.

```
Prog(x){
  tmp= x
  for(i = 1; i < x; i++)
    tmp=tmp*i;
  return tmp;
}
```

3. In a graph G , a *clique* is a set of vertices all with edges directly between them. Consider the following problem: given graph G and integer k , is there a clique in G of at least k vertices? Prove that the clique problem is NP-Complete. (It may help to think to think about the Independent Set problem, already known to be NP-complete.)