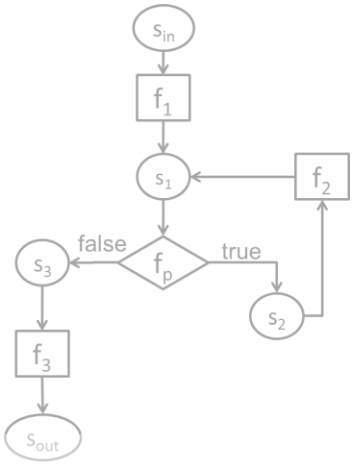
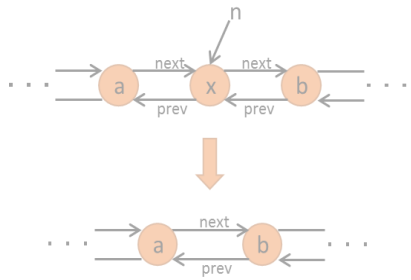
$$\exists c \forall in\ Q(c, in)$$

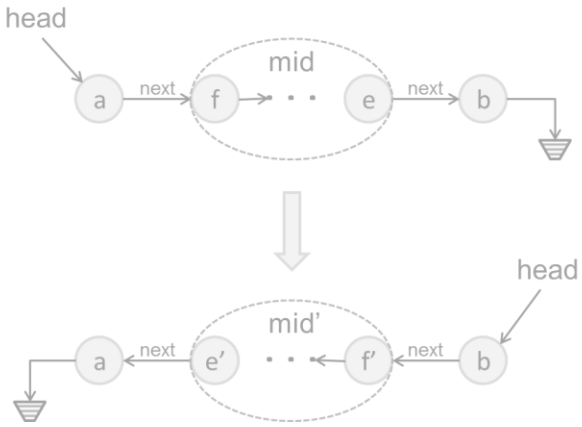
```
/* Average of x and y without using x+y (avoid overflow)*/
int avg(int x, int y){
  int t = expr({x/2, y/2, x%2, y%2, 2 }, {PLUS, DIV});
  assert t == (x+y)/2;
  return t;
}
```

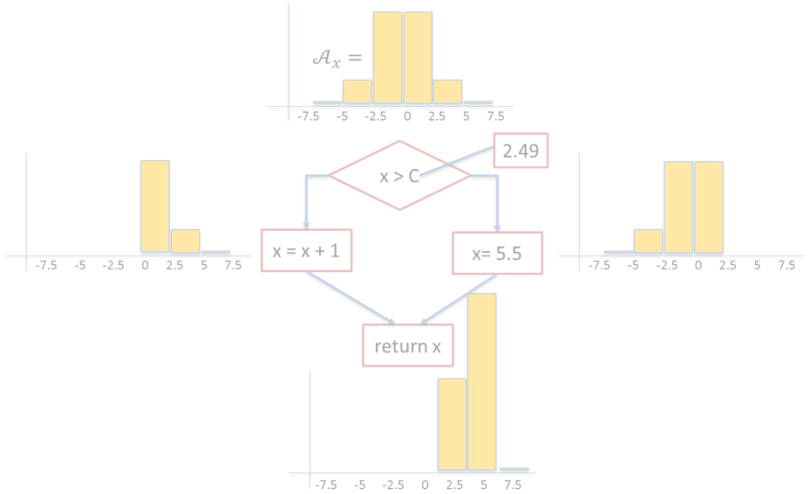





```
{
  s  = n.succ;
  p = n.pred;
  p.succ = s;
  s.pred = p;
}
```

Welcome to Program Synthesis!





$$\varphi(p)$$

$$Sk[c](in)$$

Administrivia

Who are we?

Xiaokang Qiu

xkqiu@purdue.edu

Associate Professor of Electrical and Computer Engineering, Purdue University

Research interests: programming languages, formal methods, and software engineering, making programming easier, more reliable and more productive

How about you?

- ***Assignment 0:*** email me! ☺
- Attend my office hour!

What is this course about?

The goal of the course is to introduce program synthesis, one of the most central research problems in computer science and AI.

- You'll get familiar with state-of-the-art approaches to the problem including recent AI-powered advancements as well as open problem in the area.
- Each person is expected to learn one or more core techniques in detail and use it in a concrete project, giving a theoretical or practical contribution.

– First half: Lectures covering core synthesis techniques
– Second half: Paper discussion and project presentation
– No final exam

Logistics

Office Course Website

- https://xkqiu.github.io/SNU-program-synthesis/
- Syllabus, Assignments, Slides, etc.
- Check regularly for latest announcements
- Reference book: *S. Gulwani, O. Polozov and R. Singh.* ***Program Synthesis****. 2017.*

Office Hours

- Mondays and Wednesdays 3:30-4:30pm (Room 321, Building 302)

Grading

- 30% — Assignments (three expected)
- 20% — Paper Presentation (lead discussion for a research paper)
- 50% — Project (apply program synthesis techniques to a project of your choice)

Project (very tentative)

Teams of 2 or 3 people (2%)
- Expectations commensurate with size of team

1-page project proposal (13%)
- Tell us what you plan to do, why the idea is novel (literature review) and give some evidence that you've started to work on it

Project presentation (15%)

Project report (20%)

Hopefully be at the level of a conference publication. Will be judged in terms of
- quality of execution
- originality
- scope

Key Dates (very tentative)

March 26: Assignment 1 due
March 31: Paper assignment due
April 16: Project proposal due
April 21: Assignment 2 due
April 23: Paper presentation begins
May 19: Assignment 3 due
May 21: Paper presentation ends
May 26: Project presentation begins
June 11: Project presentation ends
June 16: Project report due