PS #2 Thu 9/22 11:59 PM
Q #2 Thu 9/22 First 10 min
- Through today
9/27 - Walker white, no RDZ O.H.
P1 review Wed evening 9/28

2.8
3.3

Correctness of software

"Hey it worked!" (on my examples)

coverage
run-time checks assert

Pair programming

Verification: proof code works on all inputs

code

All outputs obey specification
Program correctness proofs
Guest Stars in P1 + F

Tools:
- Induction
- Substitution models

Induction recipe
1. Statement \[ \sum_{i=1}^{n} i = n(n+1)/2 \]
2. Variable n
3. Proof of base case P[1]
4. Proof that \( \forall n (P[n] \Rightarrow P[n+1]) \)

Pick an n, assume \( P[n] \), prove \( P[n+1] \)

I.H.

\[
\begin{align*}
\text{let rec fact(n)} &= \\
in 1 \text{ then } 1 \text{ else } n \times \text{fact}(n-1)
\end{align*}
\]

\( P[n] = \) The value of the expression fact n is \( n! \)
1. Statement: "fact works on n".
   For integer n ≥ 1, value of fact n is n!

2. n

3. P[1]
   Fact 1 by Substitution model apply function
   if 1 = 1 then 1 else 1 != fact (1-1)
   by b.s.m. if, =
   if true then 1 else 1 = fact (1-1)
   b.s.m. if
   1

4. Proof: P[n]⇒P[n+1]
   Assume fact works for n, show works for n+1
   fact n+1
   b.s.m. (apply)
   if n+1 = 1, then 1 else n+1 = fact (n+1-1)
   since n ≥ 1, n+1 ≥ 2, n+1 =
   the value of n+1 = 1 is false b.s.m (=)
   if false then
   b.s.m. (f)
   n+1 = fact (n+1-1)
   b.s.m. (f) n+1-1 = n
   n+1 = fact (n)
   BY INDUCTION HYPOTHESIS
   fact(n) is n!
   n+1 × n!
   (n+1)! Q.E.D