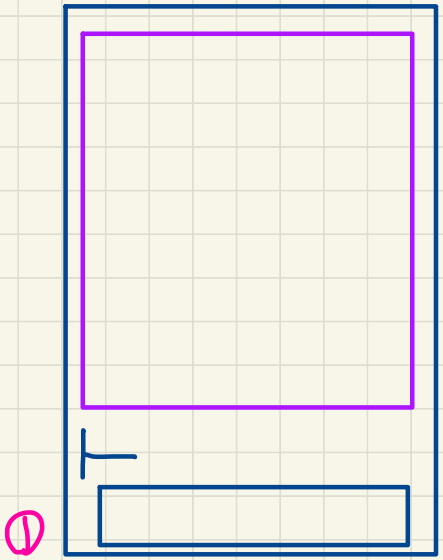
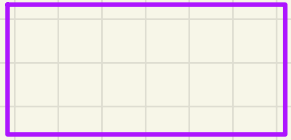
Review Q & A - Dec. 13

Exam Review Q&A



② select (or sketch) the predicated related to the variables

MON



① Examine what's to be proved

(1) structure ($\Rightarrow$, $>$, $=$)

(2) variables involved

③ From there, see how these hypotheses are related to the goal.

1. data sheet
2. inference rules applicable

$P \equiv \neg(\neg P)$

Discharging POs of m2: Invariant Preservation

Second Attempt

ML_out/inv2_4/INV

$d \in \mathbb{N}$
$d > 0$
$COLOUR = \{green, red\}$
$green \neq red$
$n \in \mathbb{N}$
$n \leq d$
$a \in \mathbb{N}$
$b \in \mathbb{N}$
$c \in \mathbb{N}$
$a + b + c = n$
$a = 0 \vee c = 0$
$ml\_tl \in COLOUR$
$il\_tl \in COLOUR$
$ml\_tl = green \Rightarrow a + b < d \wedge c = 0$
$il\_tl = green \Rightarrow b > 0 \wedge a = 0$
$ml\_tl = red \vee il\_tl = red$
$ml\_tl = green$
$\vdash$
$il\_tl = green \Rightarrow b > 0 \wedge (a + 1) = 0$

MON

$green \neq red$
$il\_tl = green \Rightarrow b > 0 \wedge a = 0$
$ml\_tl = red \vee il\_tl = red$
$ml\_tl = green$
$\vdash$
$il\_tl = green \Rightarrow b > 0 \wedge (a + 1) = 0$

IMP_R

$green \neq red$
$il\_tl = green \Rightarrow b > 0 \wedge a = 0$
$ml\_tl = green$
$ml\_tl = red \vee il\_tl = red$
$il\_tl = green$
$\vdash$
$b > 0 \wedge (a + 1) = 0$

IMP_L

$green \neq red$
$b > 0 \wedge a = 0$
$ml\_tl = green$
$ml\_tl = red \vee il\_tl = red$
$il\_tl = green$
$\vdash$
$b > 0 \wedge (a + 1) = 0$

AND_L

$green \neq red$
$b > 0$
$a = 0$
$ml\_tl = green$
$ml\_tl = red \vee il\_tl = red$
$il\_tl = green$
$\vdash$
$b > 0 \wedge (a + 1) = 0$

AND_R

$green \neq red$
$ml\_tl = green$
$ml\_tl = red \vee il\_tl = red$
$il\_tl = green$
$\vdash$
$ml\_tl = green \Rightarrow b > 0 \wedge (a + 1) = 0$

OR_L

$green \neq red$
$ml\_tl = green$
$ml\_tl = red \vee il\_tl = red$
$il\_tl = green$
$\vdash$
$1 = 0$

$green \neq red$ ✗
$ml\_tl = green$
$ml\_tl = red$
$il\_tl = green$
$\vdash$
$1 = 0$

EQ_LR, MON

$green \neq red$
$b > 0$
$a = 0$
$ml\_tl = green$
$ml\_tl = red \vee il\_tl = red$
$il\_tl = green$
$\vdash$
$b > 0$

HYP

$green \neq red$
$b > 0$
$a = 0$
$ml\_tl = green$
$ml\_tl = red \vee il\_tl = red$
$il\_tl = green$
$\vdash$
$(a + 1) = 0$

EQ_LR, MON

$green \neq red$
$ml\_tl = green$
$ml\_tl = red \vee il\_tl = red$
$il\_tl = green$
$\vdash$
$(0 + 1) = 0$

ARI

$green \neq red$
$ml\_tl = green$
$ml\_tl = red \vee il\_tl = red$
$il\_tl = green$
$\vdash$
$1 = 0$

exercise

$\neg(green = red)$

Approach 1: NOT_L

$green \neq red$
$green = red$
$tl\_tl = green$
$\vdash$
$1 = 0$

Approach 2: green = red 也false

NOT_L
$green = red$ (F)
$tl\_tl = green$
$1 \neq 0$ (T)
$\vdash$
$green = red$ (F)

ARI

Contra-positive.
$\neg P \Rightarrow Q \equiv \neg Q \Rightarrow P$

$$\frac{H, \neg Q \vdash P}{H, \neg P \vdash Q}\ \text{NOT\_L}$$ ✓

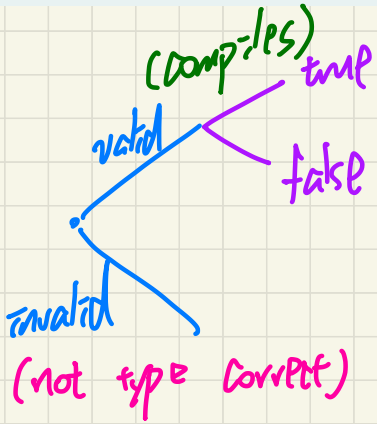
$$\frac{H(F), E = F \vdash P(F)}{H(E), E = F \vdash P(E)}\ \text{EQ\_LR}$$

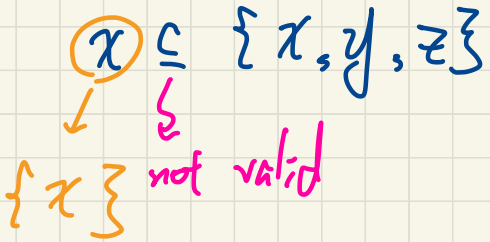
$$\frac{H, P \vdash R \qquad H, Q \vdash R}{H, P \vee Q \vdash R}\ \text{OR\_L}$$

{} : {a, b, c, d} +->> {23, 46, 69}	Choose...
{(a, 23), (b, 46), (c, 69), (d, 81)} <: {a, b, c, d} >+> {23, 46, 69, 81, 98, 101}	Choose...
{} : {a, b, c, d} >+> {23, 46, 69}	Choose...
{(1, a), (2, b), (3, c), (4, a)} /: {1, 2, 3, 4} >->> {a, b, c}	Choose...
{} <: {a, b, c, d} >-> {23, 46, 69}	Choose...

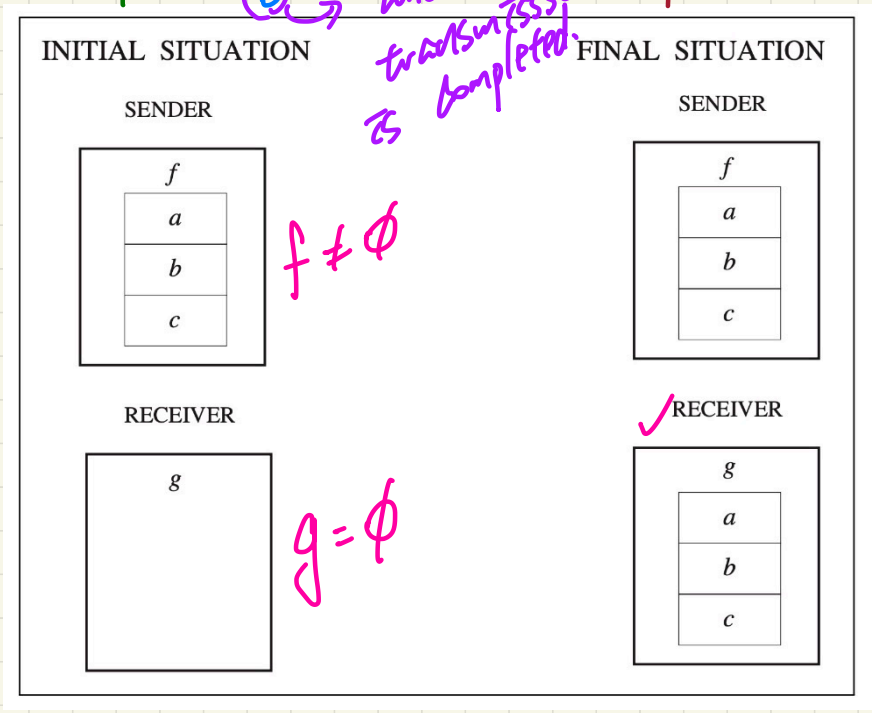
set of all possible partial injections

subset





pre-trans. b = false whether or not transmission is completed. post-trans. b = true.



$f \neq \phi$

$g = \phi$

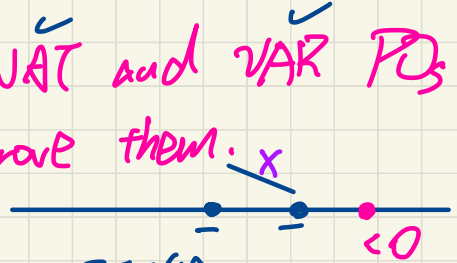
$f' = f$

$g' = f$

- Find a trace to prove some given variant?
  - even if this witness shows that the NAT and VAR properties are satisfied, it's not sufficient.

$$\forall \text{ traces} \cdot \text{NAT} \wedge \text{VAR}$$

To prove a given variant, state NAT and VAR POs and prove them.



- To disprove a variant being valid/appropriate, find a witness trace which violates either NAT or VAR.

Assume a model consisting of the following components (where A1, I1, G1, and G2 are some valid predicates referring to the declared constants and/or variables):

- An axiom: A1
- An invariant: I1
- An event e1 with guard: G1
- An event e2 with guard: G2

Before the change: DLF condition is $G_1 \vee G_2$

After the change: $(G_1 \wedge P) \vee G_2$

Consider each of the following 9 possible changes, introduced to the above model, **in isolation**:

1. Adding a new axiom A2 (where A2 is a valid predicate)
2. Changing event e1's guard to "G1 & P" (where P is some valid predicate)
3. Changing event e1's guard to "G1 or P" (where P is some valid predicate)
4. Removing axiom A1
5. Removing e2's guard G2 (so that it has no guard)
6. Adding a new, second guard G2' (where G2' is a valid predicate) to event e2
7. Adding a new invariant I2 (where I2 is a valid predicate)
8. Adding a new event e3 with guard G3 (where G3 is a valid predicate)
9. Removing invariant I1