Appendix A

Isabelle/Isar quick reference

A.1 Proof commands

A.1.1 Primitives and basic syntax

fix x	augment context by $\bigwedge x.\ \square$
assume a: φ	augment context by $\varphi \Longrightarrow \square$
then	indicate forward chaining of facts
have a: φ	prove local result
show a: φ	prove local result, refining some goal
using a	indicate use of additional facts
unfolding a	unfold definitional equations
proof m_1 ... **qed** m_2	indicate proof structure and refinements
{ ... **}**	indicate explicit blocks
next	switch blocks
note $a = b$	reconsider facts
let $p = t$	abbreviate terms by higher-order matching
write c (mx)	declare local mixfix syntax

proof = *prfx** **proof** *method*$^?$ *stmt** **qed** *method*$^?$
| *prfx** **done**

prfx = **apply** *method*
| **using** *facts*
| **unfolding** *facts*

stmt = **{** *stmt** **}**
| **next**
| **note** *name* = *facts*
| **let** *term* = *term*
| **write** *name* (*mixfix*)
| **fix** *var*$^+$
| **assume** *name*: *props*
| **then**$^?$ *goal*

goal = **have** *name*: *props proof*
| **show** *name*: *props proof*

A.1.2 Abbreviations and synonyms

by m_1 m_2	$\equiv$	**proof** m_1 **qed** m_2
..	$\equiv$	**by** *rule*
.	$\equiv$	**by** *this*
hence	$\equiv$	**then have**
thus	$\equiv$	**then show**
from a	$\equiv$	**note** a **then**
with a	$\equiv$	**from** a **and** *this*
from *this*	$\equiv$	**then**
from *this* **have**	$\equiv$	**hence**
from *this* **show**	$\equiv$	**thus**

A.1.3 Derived elements

$\textbf{also}_0$	$\approx$	**note** *calculation* = *this*
$\textbf{also}_{n+1}$	$\approx$	**note** *calculation* = *trans* [*OF calculation this*]
finally	$\approx$	**also from** *calculation*
moreover	$\approx$	**note** *calculation* = *calculation this*
ultimately	$\approx$	**moreover from** *calculation*
presume a: φ	$\approx$	**assume** a: φ
def a: $x \equiv t$	$\approx$	**fix** x **assume** a: $x \equiv t$
obtain x **where** a: φ	$\approx$	... **fix** x **assume** a: φ
case c	$\approx$	**fix** x **assume** c: φ
sorry	$\approx$	**by** *cheating*

A.1.4 Diagnostic commands

pr	print current state
thm a	print fact
prop φ	print proposition
term t	print term
typ τ	print type

A.2 Proof methods

Single steps (forward-chaining facts)

assumption	apply some assumption
this	apply current facts
rule a	apply some rule
rule	apply standard rule (default for **proof**)
contradiction	apply ¬ elimination rule (any order)
cases t	case analysis (provides cases)
induct x	proof by induction (provides cases)

Repeated steps (inserting facts)

–	no rules
intro a	introduction rules
intro_classes	class introduction rules
elim a	elimination rules
unfold a	definitional rewrite rules

Automated proof tools (inserting facts)

iprover	intuitionistic proof search
blast, *fast*	Classical Reasoner
simp, *simp_all*	Simplifier (+ Splitter)
auto, *force*	Simplifier + Classical Reasoner
arith	Arithmetic procedures

A.3 Attributes

Rules

OF a	rule resolved with facts (skipping "_")
of t	rule instantiated with terms (skipping "_")
where x = t	rule instantiated with terms, by variable name
symmetric	resolution with symmetry rule
THEN b	resolution with another rule
rule_format	result put into standard rule format
elim_format	destruct rule turned into elimination rule format

Declarations

simp	Simplifier rule
intro, *elim*, *dest*	Pure or Classical Reasoner rule
iff	Simplifier + Classical Reasoner rule
split	case split rule
trans	transitivity rule
sym	symmetry rule

A.4 Rule declarations and methods

	rule	*iprover*	*blast* *fast*	*simp* *simp_all*	*auto* *force*
Pure.elim! *Pure.intro*!	×	×			
Pure.elim Pure.intro	×	×			
elim! *intro*!	×		×		×
elim intro	×		×		×
iff	×		×	×	×
iff ?	×				
elim? intro?	×				
simp				×	×
cong				×	×
split				×	×

A.5 Emulating tactic scripts

A.5.1 Commands

apply *m*	apply proof method at initial position
apply_end *m*	apply proof method near terminal position
done	complete proof
defer *n*	move subgoal to end
prefer *n*	move subgoal to beginning
back	backtrack last command

A.5.2 Methods

rule_tac insts	resolution (with instantiation)
erule_tac insts	elim-resolution (with instantiation)
drule_tac insts	destruct-resolution (with instantiation)
frule_tac insts	forward-resolution (with instantiation)
cut_tac insts	insert facts (with instantiation)
thin_tac φ	delete assumptions
subgoal_tac φ	new claims
rename_tac x	rename innermost goal parameters
rotate_tac n	rotate assumptions of goal
tactic text	arbitrary ML tactic
case_tac t	exhaustion (datatypes)
induct_tac x	induction (datatypes)
ind_cases t	exhaustion + simplification (inductive predicates)