

Supplementary Material

Proof Repair Infrastructure for Supervised Models: Building a Large Proof Repair Dataset

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This appendix contains details about the projects contained in the Proof Repair Infrastructure for Supervised Models (PRISM) dataset and benchmark suite (Section 1) and discusses the format of a repair instance through the use of a small example (Section 2).

1 Dataset Project Sources

This section serves as a reference for current and pending Git repositories that are slated for inclusion in the initial and subsequent versions of the PRISM dataset and benchmark suite. Note that the proof and sentence counts in the following tables are only approximations and correspond to a *single* commit from each project that was at the time the most recent (or nearly so) in each project’s corresponding Git repository. Furthermore, note that the count of sentences is not an estimate of the number of definitions as each step of a proof is technically a sentence. The counts were approximated using the heuristic parser described in Sections 4.4 and 5.1, which on top of parsing sentence boundaries without requiring compilation also possesses the capacity to parse (nested) proof boundaries to a high degree of accuracy.

Projects with zero estimated proofs are included in the dataset despite the expected inability to perform proof repair on them. Instead, these projects can serve as additional training data for language models or as data for eventual specification repair tasks.

Table 1 contains the list of 60 projects on which efforts currently focus. Each of these projects is publicly released as an OCaml Package Manager (opam) package, which to some degree simplifies the determination of dependencies and project building. However, the projects may not have been opam packages for their entire lifetime. Thus, supporting the entire history of each may require similar infrastructure as supporting arbitrary project build processes.

Table 1: The complete list of projects included in the initial release of PRISM.

Project	Proof Count	Sentence Count	Repository URL
Abel	429	4063	github.com/math-comp/Abel
analysis	4663	39651	github.com/math-comp/analysis
atbr	819	11089	github.com/coq-community/atbr

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bellantonicook	498	7515	github.com/davidnowak/bellantonicook
bigenough	5	43	github.com/math-comp/bigenough
bits	436	4895	github.com/coq-community/bits
celsius	211	4470	github.com/clementblauveau/celsius
cerise	1026	35029	github.com/logsem/cerise
certicoq	4350	133553	github.com/CertiCoq/certicoq
CertiGraph	3522	106982	github.com/CertiGraph/CertiGraph
cgraphs	812	16559	github.com/julesjacobs/cgraphs
ConCert	1581	33188	github.com/AU-COBRA/ConCert
coq-cds4ltl	634	7621	github.com/jwiegley/coq-cds4ltl
coq-ceres	122	1263	github.com/Lysxia/coq-ceres
coqdeal	1609	17503	github.com/coq-community/coqdeal
coq-ext-lib	297	4842	github.com/coq-community/coq-ext-lib
coq-haskell	481	5512	github.com/jwiegley/coq-haskell
coq-http	27	795	github.com/liyishuai/coq-http
coq-list-string	9	207	github.com/clarus/coq-list-string
coqoban	3	455	github.com/coq-community/coqoban
coq-procrastination	60	506	github.com/Armael/coq-procrastination
coq-robot	1505	13575	github.com/affeldt-aist/coq-robot
coq-simple-io	0	267	github.com/Lysxia/coq-simple-io
coqtail-math	2515	35411	github.com/coq-community/coqtail-math
coquelicot	1853	32813	gitlab.inria.fr/coquelicot/coquelicot
dblib	244	1994	github.com/coq-community/dblib
deriving	67	1567	github.com/arthuraa/deriving
dot-iris	1590	12473	github.com/Blaisorblade/dot-iris
event-struct	1039	11142	github.com/Event-Structures/event-struct
fcs1-pcm	2118	15806	github.com/imdea-software/fcs1-pcm
finmap	870	5058	github.com/math-comp/finmap
FormalML	7026	135311	github.com/IBM/FormalML
generic-environments	269	2818	github.com/coq-community/generic-environments
goedel	103	8548	github.com/coq-community/goedel
graph-theory	2272	29435	github.com/coq-community/graph-theory
hoare-tut	25	346	github.com/coq-community/hoare-tut
HoTT	4974	62461	github.com/HoTT/HoTT
htt	410	4143	github.com/imdea-software/htt
huffman	285	3910	github.com/coq-community/huffman
infotheo	3335	45155	github.com/affeldt-aist/infotheo
InfSeqExt	145	1943	github.com/DistributedComponents/InfSeqExt
InteractionTrees	1822	45795	github.com/DeepSpec/InteractionTrees
katamaran	854	14929	github.com/katamaran-project/katamaran
lemma-overloading	840	6476	github.com/coq-community/lemma-overloading
math-classes	1741	17370	github.com/coq-community/math-classes
math-comp	14263	104712	github.com/math-comp/math-comp
monae	1661	16336	github.com/affeldt-aist/monae
multinomials	1008	7573	github.com/math-comp/multinomials
pocklington	265	6546	github.com/coq-community/pocklington
qarith-stern-brocot	1131	16216	github.com/coq-community/qarith-stern-brocot
QuickChick	1211	13104	github.com/QuickChick/QuickChick
quicksort-complexity	591	8858	github.com/coq-contribs/quicksort-complexity
SeLoC	381	7840	github.com/co-dan/SeLoC
ssprove	1298	21179	github.com/SSProve/ssprove
sudoku	250	4015	github.com/coq-community/sudoku
tarjan	459	5187	github.com/math-comp/tarjan
tlc	2314	24176	github.com/charguer/tlc
topology	616	16461	github.com/coq-community/topology
toychain	264	4320	github.com/certichain/toychain
verdi-chord	990	16420	github.com/DistributedComponents/verdi-chord
Total	171,775	2,984,471	

Table 2 contains a list of 224 projects that serve as a pool for potential dataset expansion. These projects are not available on opam and have varying degrees of maturity and rigor in their development and build processes. These projects were selected based on the criteria mentioned in Section 3.2. Consequently, some projects listed here may yet be excluded from consideration for unforeseen complications.

Table 2: The list of candidate projects slated for consideration in a subsequent release of PRISM.

Project	Proof Count	Sentence Count	Repository URL
additions	103	1425	github.com/coq-contribs/additions
ails	225	4605	github.com/coq-contribs/ails
algebra	559	6609	github.com/coq-contribs/algebra
AML-Formalization	1532	43978	github.com/harp-project/AML-Formalization
amm11262	28	1154	github.com/coq-contribs/amm11262
angles	93	2013	github.com/coq-contribs/angles
area-method	779	10603	github.com/coq-contribs/area-method
argosy	304	3614	github.com/mit-pdos/argosy
asn1fpcq	194	2982	github.com/digamma-ai/asn1fpcq
automata	344	5833	github.com/coq-contribs/automata
axiomatic-abp	399	4494	github.com/coq-contribs/axiomatic-abp
bbv	653	7343	github.com/mit-plv/bbv
bdds	232	15510	github.com/coq-contribs/bdds
bedrock	4423	66779	github.com/mit-plv/bedrock
bedrock2	1233	32668	github.com/mit-plv/bedrock2
bedrock-mirror-shard	1726	18771	github.com/gmalecha/bedrock-mirror-shard
bignums	638	9191	github.com/coq-community/bignums
buchberger	753	9705	github.com/coq-community/buchberger
cage	456	7425	github.com/gstew5/cage
Categories	519	7757	github.com/amintimany/Categories
category-theory	1377	15827	github.com/jwieglej/category-theory
cecoa	1281	33151	github.com/davidnowak/cecoa
ceramist	427	8223	github.com/verse-lab/ceramist
ChargeCore	299	3750	github.com/jesper-bengtson/ChargeCore
checker	4	55	github.com/coq-contribs/checker
cheerios	83	1078	github.com/uwplse/cheerios
chinese	137	1769	github.com/coq-contribs/chinese
circuits	220	2723	github.com/coq-contribs/circuits
ClassicalReal	1303	48201	github.com/QinxiangCao/ClassicalReal
cls-coq	611	20968	github.com/combinators/cls-coq
color	6743	113300	github.com/fblanqui/color
CompCert	7835	156983	github.com/AbsInt/CompCert
CompCertM	1499	72820	github.com/snu-sf/CompCertM
CompCertR	7817	161208	github.com/snu-sf/CompCertR
concat	514	6417	github.com/coq-contribs/concat
constructive-geometry	116	902	github.com/coq-contribs/constructive-geometry
constructive-ltl	634	7621	github.com/jwieglej/constructive-ltl
containers	1417	12466	github.com/coq-contribs/containers
coq-bitset	147	3755	github.com/artart78/coq-bitset
Coq-Combi	3520	37470	github.com/math-comp/Coq-Combi
coq-compile	29	2330	github.com/coq-ext-lib/coq-compile
coq-cunit	0	7	github.com/clarus/coq-cunit
coq-error-handlers	0	10	github.com/clarus/coq-error-handlers
Coq-Flow-Equivalence	376	8278	github.com/GaloisInc/Coq-Flow-Equivalence
coq-forcing	72	1190	github.com/CoqHott/coq-forcing
coq-forcing	72	1190	github.com/CoqHott/coq-forcing
coq-function-ninjas	0	3	github.com/clarus/coq-function-ninjas
coq-guarded-computational-type-theory	205	3824	github.com/jonsterling/coq-guarded-computational-type-theory
coq-http2	47	943	github.com/liyishuai/coq-http2
coq-iterable	0	15	github.com/clarus/coq-iterable
coq-library-complexity	2438	43607	github.com/uds-psl/coq-library-complexity
coq-library-undecidability	10281	153181	github.com/uds-psl/coq-library-undecidability
coq-list-plus	0	42	github.com/clarus/coq-list-plus
coq-performance-tests	170	2536	github.com/coq-community/coq-performance-tests
Coq-Polyhedra	1086	11773	github.com/Coq-Polyhedra/Coq-Polyhedra
coq-record-update	6	243	github.com/tchajed/coq-record-update
coqrel	270	1763	github.com/CertiKOS/coqrel
coqutil	797	9516	github.com/mit-plv/coqutil
coq-utils	298	2820	github.com/arthuraa/coq-utils
Core-Erlang-Formalization	550	12170	github.com/harp-project/Core-Erlang-Formalization

corespec	1510	21682	github.com/sweirich/corespec
cours-de-coq	92	792	github.com/coq-contribs/cours-de-coq
cpdt-japanese	431	3152	github.com/cpdt-japanese/cpdt-japanese
cps	436	9211	github.com/takanuva/cps
crellvm	722	22052	github.com/snu-sf/crellvm
cryptis	448	5751	github.com/arthuraa/cryptis
cspec	884	11566	github.com/mit-pdos/cspec
ct	161	1948	github.com/relrod/ct
ctlctl	28	383	github.com/coq-contribs/ctlctl
DeepSpecDB	2719	86898	github.com/PrincetonUniversity/DeepSpecDB
demos	69	477	github.com/coq-contribs/demos
dep-map	90	1843	github.com/coq-contribs/dep-map
dez	1523	20350	github.com/Tuplanolla/dez
dictionaries	67	845	github.com/coq-contribs/dictionaries
disel	844	12582	github.com/DistributedComponents/disel
distributed-reference-counting	954	24025	github.com/coq-contribs/distributed-reference-counting
domains	1738	58184	github.com/robdockins/domains
domain-theory	51	812	github.com/coq-contribs/domain-theory
engine-bench	94	1264	github.com/mit-plv/engine-bench
ett-to-wtt	433	13925	github.com/TheoWinterhalter/ett-to-wtt
euler-formula	162	6757	github.com/coq-contribs/euler-formula
exceptions	3	94	github.com/coq-contribs/exceptions
exploring-robust-property-preservation	295	6518	github.com/secure-compilation/exploring-robust-property-preservation
extractures	357	2986	github.com/arthuraa/extractures
fermat4	130	841	github.com/coq-contribs/fermat4
fiat	5932	84544	github.com/mit-plv/fiat
float	780	10192	github.com/coq-contribs/float
formal-type-theory	67	10680	github.com/TheoWinterhalter/formal-type-theory
frap	1870	23058	github.com/achlipala/frap
free-groups	33	484	github.com/coq-contribs/free-groups
fssec-model	153	3255	github.com/coq-contribs/fssec-model
functional-algebra	278	1286	github.com/llee454/functional-algebra
functions-in-zfc	632	2437	github.com/coq-contribs/functions-in-zfc
fundamental-arithmetics	152	1941	github.com/coq-contribs/fundamental-arithmetics
general-type-theories	546	10172	github.com/peterlefanulumsdaine/general-type-theories
GeoCoq	4087	122527	github.com/GeoCoq/GeoCoq
GraphCoQL	220	2513	github.com/imfd/GraphCoQL
graphs	174	4460	github.com/coq-contribs/graphs
groups	14	134	github.com/coq-contribs/groups
group-theory	105	1099	github.com/coq-contribs/group-theory
hahn	1458	9836	github.com/vafeiadis/hahn
hanoi	577	10514	github.com/they/hanoi
hardware	186	1643	github.com/coq-contribs/hardware
hedges	110	2310	github.com/coq-contribs/hedges
helix	2046	56461	github.com/vzaliva/helix
higman-cf	30	279	github.com/coq-contribs/higman-cf
higman-s	49	913	github.com/coq-contribs/higman-s
HoTT-categories	380	4559	github.com/CategoricalData/HoTT-categories
hybrid	524	7099	github.com/Eelis/hybrid
idxassoc	58	713	github.com/coq-contribs/idxassoc
ieee754	15	239	github.com/coq-contribs/ieee754
IFC	756	11435	github.com/QuickChick/IFC
imm	1444	24624	github.com/weakmemory/imm
infinitary-rewriting-coq	262	4207	github.com/martijnvermaat/infinitary-rewriting-coq
int-map	494	7816	github.com/coq-contribs/int-map
ipc	479	9102	github.com/coq-contribs/ipc
iris-coq	4299	32669	github.com/izgzhen/iris-coq
iron	1519	30137	github.com/discus-lang/iron
izf	122	827	github.com/coq-contribs/izf
jordan-curve-theorem	663	42492	github.com/coq-contribs/jordan-curve-theorem
kami	2092	41182	github.com/mit-plv/kami
Kami	2120	37732	github.com/sifive/Kami
Ktheory	40	505	github.com/DanGrayson/Ktheory
lambda	90	941	github.com/coq-contribs/lambda
largecatmodules	467	9644	github.com/UniMath/largecatmodules
lazy-pcf	83	1587	github.com/coq-contribs/lazy-pcf
lesniewski-mereology	140	1396	github.com/coq-contribs/lesniewski-mereology

lin-alg	543	10797	github.com/coq-contribs/lin-alg
linearscan	304	4786	github.com/jwiegley/linearscan
llvmtwin-coq	675	34538	github.com/snu-sf/llvmtwin-coq
LOGIC	1729	25450	github.com/QinxiangCao/LOGIC
loopring-protocol2-verification	155	3718	github.com/sec-bit/loopring-protocol2-verification
lvc	3782	60531	github.com/sigurdtschneider/lvc
maple-mode	20	154	github.com/coq-contribs/maple-mode
MapleS	7629	153467	github.com/namefanwjcom/MapleS
markov	31	951	github.com/coq-contribs/markov
maths	38	386	github.com/coq-contribs/maths
memory-safe-language	72	1325	github.com/arthuraa/memory-safe-language
metacoq	8885	161078	github.com/MetaCoq/metacoq
metalib	796	8026	github.com/plclub/metalib
micro-policies-coq	569	13727	github.com/micro-policies/micro-policies-coq
mini-compiler	4	86	github.com/coq-contribs/mini-compiler
miniml	12	681	github.com/coq-contribs/miniml
mirror-core	1380	36458	github.com/gmalecha/mirror-core
mirror-shard	636	12465	github.com/gmalecha/mirror-shard
mod-red	271	6204	github.com/coq-contribs/mod-red
oeuf	10471	186512	github.com/uwplse/oeuf
orb-stab	40	1590	github.com/coq-contribs/orb-stab
otway-rees	21	613	github.com/coq-contribs/otway-rees
paco	1519	23749	github.com/snu-sf/paco
paramcoq-iff	285	6527	github.com/aa755/paramcoq-iff
param-pi	72	3853	github.com/coq-contribs/param-pi
parsing-parses	274	3512	github.com/JasonGross/parsing-parses
perennial	5284	137211	github.com/mit-pdos/perennial
pigeons	6	34	github.com/llee454/pigeons
pipcore	1637	130325	github.com/2xs/pipcore
pnp	356	2857	github.com/ilyasergey/pnp
PolTac	309	2247	github.com/thery/PolTac
probchain	246	4801	github.com/certichain/probchain
ProcKami	54	2055	github.com/sifive/ProcKami
promising-coq	835	29947	github.com/snu-sf/promising-coq
proofs	174	2558	github.com/stepchowfun/proofs
propcalc	66	629	github.com/coq-contribs/propcalc
pts	350	4513	github.com/coq-contribs/pts
puiseuxth	910	20553	github.com/roglo/puiseuxth
qarith	60	1151	github.com/coq-contribs/qarith
quadcopter	1061	34482	github.com/dricketts/quadcopter
QuantumLib	1482	20473	github.com/inQWIRE/QuantumLib
QWIRE	1167	18932	github.com/inQWIRE/QWIRE
railroad-crossing	100	1108	github.com/coq-contribs/railroad-crossing
ramsey	8	55	github.com/coq-contribs/ramsey
regexp	105	1556	github.com/coq-contribs/regexp
regex-reexamined-coq	476	7609	github.com/awalterschulze/regex-reexamined-coq
rem	8	113	github.com/coq-contribs/rem
rewriter	1436	13713	github.com/mit-plv/rewriter
riscv-coq	209	3367	github.com/samuelgruetter/riscv-coq
rsa	113	1194	github.com/coq-contribs/rsa
ruler-compass-geometry	332	4376	github.com/coq-contribs/ruler-compass-geometry
SCEV-coq	23	475	github.com/bollu/SCEV-coq
schroeder	14	276	github.com/coq-contribs/schroeder
search-trees	50	593	github.com/coq-contribs/search-trees
Set-Theory	2703	66081	github.com/choukh/Set-Theory
shuffle	40	430	github.com/coq-contribs/shuffle
silveroak	1519	26477	github.com/project-oak/silveroak
sirtt	179	4645	github.com/TheoWinterhalter/sirtt
smc	685	25108	github.com/coq-contribs/smc
SQIR	1713	37680	github.com/inQWIRE/SQIR
SquiggleEq	1302	16922	github.com/aa755/SquiggleEq
ssrbit	344	2966	github.com/ejgallego/ssrbit
StdLibKami	72	4505	github.com/sifive/StdLibKami
StructTact	287	3563	github.com/uwplse/StructTact
subst	417	3650	github.com/coq-contribs/subst
system	1	112	github.com/coq-concurrency/system
tarski-geometry	136	2702	github.com/coq-contribs/tarski-geometry
three-gap	81	1091	github.com/coq-contribs/three-gap

tortoise-hare-algorithm	4	82	github.com/coq-contribs/tortoise-hare-algorithm
transfer	201	1726	github.com/Zimmi48/transfer
traversable-fincontainer	71	871	github.com/coq-contribs/traversable-fincontainer
tree-automata	834	24988	github.com/coq-contribs/tree-automata
twoSquare	202	1769	github.com/theyy/twoSquare
TypeTheory	1923	30575	github.com/UniMath/TypeTheory
UnifySL	1193	19223	github.com/QinxiangCao/UnifySL
UnifySL	1193	19223	github.com/QinxiangCao/UnifySL
UniMath	15201	256571	github.com/UniMath/UniMath
Valuations	184	5079	github.com/FFaissole/Valuations
vellvm-legacy	2484	40111	github.com/vellvm/vellvm-legacy
velus	3338	58852	github.com/INRIA/velus
verdi	618	12534	github.com/uwplse/verdi
verdi-raft	2272	42557	github.com/uwplse/verdi-raft
Verified-FEC	994	20957	github.com/verified-network-toolchain/Verified-FEC
verified-ifc	884	15495	github.com/micro-policies/verified-ifc
VeriGHC	118	1522	github.com/trommler/VeriGHC
VST	27777	570848	github.com/PrincetonUniversity/VST
WasmCert-Coq	574	13803	github.com/WasmCert/WasmCert-Coq
weakestmoToImm	1282	33541	github.com/weakmemory/weakestmoToImm
weak-up-to	150	1720	github.com/coq-contribs/weak-up-to
when-good-components-go-bad	1030	23295	github.com/secure-compilation/when-good-components-go-bad
yalla	1019	30165	github.com/olaure01/yalla
ynot	885	9996	github.com/ynot-harvard/ynot
zchinese	43	781	github.com/coq-contribs/zchinese
zf	213	2977	github.com/coq-contribs/zf
zfc	241	2450	github.com/coq-contribs/zfc
zorns-lemma	183	4482	github.com/coq-community/zorns-lemma
zsearch-trees	48	639	github.com/coq-contribs/zsearch-trees
Total	335,223	6,078,063	

2 Repair Example

In their raw form, repair instances are large data structures containing detailed data about program state during the execution of each line in each compiled file of a project. Though these instances can be serialized to text, they are unsurprisingly enormous and not easily digested through somebody reading them. In Listing 1 we give a **compressed** example of a repair instance in YAML format, which can be readily loaded into a program written in a language of choice using standard libraries. The uncompressed equivalent from which Listing 1 was produced is 10 MB when serialized as a YAML file.

The general structure encoded in the YAML is common to both compressed and uncompressed forms and decomposes a repair instance into two main components: a state containing an error (line 1) and a state containing a repair or a ‘diff’ that when applied to the error state yields a repaired state (line 317).

The error further decomposes into a unique name identifying the project (line 314), an initial state (line 53), an optional change relative to the initial state (line 2), a set of locations associated with the error (line 45), and a set of tags related to the error (line 315). In this case, the tag indicates that the error occurs in a theorem (`VernacStartTheoremProof` is Coq’s internal name for theorem-type Vernacular commands).

In the compressed format, the initial state is represented by a commit hash (line 313) and an environment capturing installed opam packages (line 54). An optional offset (line 312) would capture hypothetical working tree changes in the initial state.

The change takes the form of a ‘diff’ (line 3) relative to the initial state with an optional environment (line 44) if the environment has changed. If no change is given, then one can assume that the initial state contains an error.

The repaired component of the instance follows the same structure as the initial state or a change depending on whether it is a complete state or a diff. For example, the repaired state in this instance could have been concisely represented by the commit hash `269c0cabb267be44e5d85e568c11f18562add6c4`. Instead the repaired state is represented as a Git diff from the changed state.

Listing 1: The YAML serialization of a repair instance obtained from the difference of two commits of the hoare-tut project.

```

1  error:
2    change:
3      diff:
4        text: 'diff --git a/exgcd.v b/exgcd.v
5
6          index bfac862..fe1ae41 100644
7
8          --- a/exgcd.v
9
10         +++ b/exgcd.v
11
12         @@ -18 +17,0 @@ Require Import Znumtheory.
13
14         -Require Import Bool.
15
16         @@ -144,0 +144 @@ Hint Resolve Zneq_bool_true Zneq_bool_false Zle_bool_imp_le
17         Zis_gcd_intro: zarit
18
19         +
20
21         @@ -164 +163,0 @@ Qed.
22
23         -
24
25         @@ -187 +186 @@ unfold Zwf; simpl; (intuition auto with zarith).
26
27         -cutrewrite <- ((fst e'')=(snd e'')) in H5; auto with zarith.
28
29         +replace (snd e'') with (fst e'') in H5; auto with zarith.
30
31         diff --git a/totalhoarelogic.v b/totalhoarelogic.v
32
33         index 16b08de..96ab82d 100644
34
35         --- a/totalhoarelogic.v
36
37         +++ b/totalhoarelogic.v
38
39         @@ -14 +13,0 @@ Require Export hoarelogicsemantics.
40
41         -Require Wf.
42
43         '
44     environment: null
45   error_location:
46   - beg_charno: 4179
47     bol_pos: 4179
48     bol_pos_last: 4253
49     end_charno: 4301
50     filename: exgcd.v
51     lineno: 145
52     lineno_last: 147
53   initial_state:
54     environment:
55       compiler:
56       - - base-bigarray
57         - prism.util.opam.version,OpamVersion,base
58       - - base-threads
59         - prism.util.opam.version,OpamVersion,base
60       - - base-unix
61         - prism.util.opam.version,OpamVersion,base
62       - - ocaml
63         - prism.util.opam.version,OCamlVersion,4.09.1

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64     - - ocaml-base-compiler
65     - - prism.util.opam.version,OCamlVersion,4.09.1
66     - - ocaml-config
67     - - prism.util.opam.version,OpamVersion,1
68     installed:
69     - - base
70     - - prism.util.opam.version,OpamVersion,v0.14.3
71     - - base-bigarray
72     - - prism.util.opam.version,OpamVersion,base
73     - - base-threads
74     - - prism.util.opam.version,OpamVersion,base
75     - - base-unix
76     - - prism.util.opam.version,OpamVersion,base
77     - - cmdliner
78     - - prism.util.opam.version,OCamlVersion,1.1.1
79     - - conf-findutils
80     - - prism.util.opam.version,OpamVersion,1
81     - - coq
82     - - prism.util.opam.version,OCamlVersion,8.10.2
83     - - coq-ext-lib
84     - - prism.util.opam.version,OCamlVersion,0.11.6
85     - - coq-paco
86     - - prism.util.opam.version,OCamlVersion,4.1.1
87     - - coq-serapi
88     - - prism.util.opam.version,OCamlVersion,8.10.0+0.7.2
89     - - cppo
90     - - prism.util.opam.version,OCamlVersion,1.6.9
91     - - csexp
92     - - prism.util.opam.version,OCamlVersion,1.5.1
93     - - dune
94     - - prism.util.opam.version,OCamlVersion,3.5.0
95     - - dune-configurator
96     - - prism.util.opam.version,OCamlVersion,3.5.0
97     - - num
98     - - prism.util.opam.version,OCamlVersion,1.4
99     - - ocaml
100    - - prism.util.opam.version,OCamlVersion,4.09.1
101    - - ocaml-base-compiler
102    - - prism.util.opam.version,OCamlVersion,4.09.1
103    - - ocaml-compiler-libs
104    - - prism.util.opam.version,OpamVersion,v0.12.4
105    - - ocaml-config
106    - - prism.util.opam.version,OpamVersion,1
107    - - ocamlfind
108    - - prism.util.opam.version,OCamlVersion,1.9.5
109    - - parsexp
110    - - prism.util.opam.version,OpamVersion,v0.14.2
111    - - ppx_derivers
112    - - prism.util.opam.version,OCamlVersion,1.2.1
113    - - ppx_deriving
114    - - prism.util.opam.version,OCamlVersion,5.2.1
115    - - ppx_deriving_yojson
116    - - prism.util.opam.version,OCamlVersion,3.6.1
117    - - ppx_import
118    - - prism.util.opam.version,OCamlVersion,1.9.1
119    - - ppx_sexp_conv
120    - - prism.util.opam.version,OpamVersion,v0.14.3
121    - - ppplib
122    - - prism.util.opam.version,OCamlVersion,0.25.1
123    - - result
124    - - prism.util.opam.version,OCamlVersion,1.5
125    - - seq
126    - - prism.util.opam.version,OpamVersion,base
127    - - sexplib
128    - - prism.util.opam.version,OpamVersion,v0.14.0
129    - - sexplib0
130    - - prism.util.opam.version,OpamVersion,v0.14.0
131    - - stdlib-shims

```



```

132 - prism.util.opam.version,OCamlVersion,0.3.0
133 - - yojson
134 - prism.util.opam.version,OCamlVersion,2.0.2
135 opam_version: prism.util.opam.version,OCamlVersion,2.0
136 package_metadata:
137 - - coq-certicoq
138 - "{\n opam-version: \"2.0\"\n version: \"0.9~beta+8.14\"\n synopsis: \"\n
139   A Verified Compiler for Gallina, Written in Gallina\"\n maintainer: \"\n
140   The CertiCoq Team\"\n authors: [\n   \"Andrew Appel\"\n   \"Yannick Forster\"\n
141   \"Anvay Grover\"\n   \"Joomy Korkut\"\n   \"John Li\"\n   \"Zoe\
142   \"Paraskevopoulou\"\n   \"Matthieu Sozeau\"\n   \"Matthew Weaver\"\n \
143   \"Abhishek Anand\"\n   \"Greg Morrisett\"\n   \"Randy Pollack\"\n \
144   \"Olivier Savary Belanger\"\n ]\n license: \"MIT\"\n homepage: \"\n
145   https://certicoq.org/\n bug-reports: \"https://github.com/CertiCoq/certicoq/issues\"\n
146   \n depends: [\n   \"ocaml\"\n   \"coq\" {>= \"8.14\" & < \"8.15~\"}\n \
147   \"coq-compcert\" {= \"3.9~\"}\n   \"coq-equations\" {= \"1.3+8.14~\"}\n
148   \"coq-metacoq-erasure\" {= \"8.14.dev\"}\n   \"coq-ext-lib\" {>=\
149   \"0.11.5~\"}\n ]\n build: [\n   [make \"all\"]\n   [make \"plugin\"]\n
150   ]\n install: [make \"install\"]\n dev-repo: \"git+https://github.com/CertiCoq/certicoq\"\n
151   \n url {\n   src:\n     \"git+file:///home/whenderson/projects/PEARLS/repos_full/certicoq#HEAD\"\n
152   }\n}"
153 - - coq-metacoq
154 - "{\n opam-version: \"2.0\"\n version: \"8.14.dev\"\n synopsis: \"A meta-programming\
155   \n framework for Coq\"\n description: \"\"\n\nMetaCoq is a meta-programming\
156   \n framework for Coq.\n\nThe meta-package includes the template-coq library,\n\n
157   the PCUIC development including a verified equivalence between Coq and PCUIC,\
158   \n\na safe type checker and verified erasure for PCUIC and example translations.\
159   \n\nSee individual packages for more detailed descriptions.\"\n\n maintainer:\
160   \n\nmatthieu.sozeau@inria.fr\"\n authors: [\n   \"Abhishek Anand <aa755@cs.cornell.edu>\"\n
161   \"Simon Boulier <simon.boulier@inria.fr>\"\n   \"Cyril Cohen <cyril.cohen@inria.fr>\"\n
162   \"Yannick Forster <forster@ps.uni-saarland.de>\"\n   \"Fabian Kunze\
163   <fkunze@fakusb.de>\"\n   \"Gregory Malecha <gmalecha@gmail.com>\"\n \
164   \"Matthieu Sozeau <matthieu.sozeau@inria.fr>\"\n   \"Nicolas Tabareau\
165   <nicolas.tabareau@inria.fr>\"\n   \"Th\xE9o Winterhalter <theo.winterhalter@inria.fr>\"\n
166   ]\n license: \"MIT\"\n homepage: \"https://metacoq.github.io/metacoq\"\n
167   \n bug-reports: \"https://github.com/MetaCoq/metacoq/issues\"\n depends:\
168   \n [\n   \"coq-metacoq-template\" {= version}\n   \"coq-metacoq-pcuic\"\
169   {= version}\n   \"coq-metacoq-safechecker\" {= version}\n   \"coq-metacoq-erasure\"\
170   {= version}\n   \"coq-metacoq-translations\" {= version}\n ]\n build:\
171   \n [\n   [\"sh\" \"/.\/configure.sh\"] {with-test}\n   [make \"-C\" \"examples\"\
172   ] {with-test}\n   [make \"-C\" \"test-suite\"] {with-test}\n ]\n dev-repo:\
173   \n\n\"git+https://github.com/MetaCoq/metacoq.git#coq-8.11\"\n url {\n \
174   \n src:\n     \"git+file:///home/whenderson/projects/PEARLS/repos_full/certicoq/submodules/metacoq#HEAD\"\n
175   }\n}"
176 - - coq-metacoq-erasure
177 - "{\n opam-version: \"2.0\"\n version: \"8.14.dev\"\n synopsis: \"Implementation\
178   \n and verification of an erasure procedure for Coq\"\n description: \"\"\n\n
179   \nMetaCoq is a meta-programming framework for Coq.\n\nThe Erasure module\
180   \n provides a complete specification of Coq's so-called\n\n\"extraction\"\n procedure,\
181   \n\nstarting from the PCUIC calculus and targeting\n\nuntyped call-by-value\
182   \n\nlambda-calculus.\n\nThe `erasure` function translates types and proofs\
183   \n\nin well-typed terms\n\ninto a dummy `tBox` constructor, following closely\
184   \n\nP. Letouzey's PhD\n\nthesis.\"\n\n\n maintainer: \"matthieu.sozeau@inria.fr\"\n
185   \n authors: [\n   \"Abhishek Anand <aa755@cs.cornell.edu>\"\n   \"Simon\
186   \"Boulier <simon.boulier@inria.fr>\"\n   \"Cyril Cohen <cyril.cohen@inria.fr>\"\n
187   \"Yannick Forster <forster@ps.uni-saarland.de>\"\n   \"Fabian Kunze\
188   <fkunze@fakusb.de>\"\n   \"Gregory Malecha <gmalecha@gmail.com>\"\n \
189   \"Matthieu Sozeau <matthieu.sozeau@inria.fr>\"\n   \"Nicolas Tabareau\
190   <nicolas.tabareau@inria.fr>\"\n   \"Th\xE9o Winterhalter <theo.winterhalter@inria.fr>\"\n
191   ]\n license: \"MIT\"\n homepage: \"https://metacoq.github.io/metacoq\"\n
192   \n bug-reports: \"https://github.com/MetaCoq/metacoq/issues\"\n depends:\
193   \n [\n   \"coq-metacoq-template\" {= version}\n   \"coq-metacoq-pcuic\"\
194   {= version}\n   \"coq-metacoq-safechecker\" {= version}\n ]\n build:\
195   \n [\n   [\"sh\" \"/.\/configure.sh\"]\n   [make \"-j\" \"%{jobs}%\" \"-C\"\
196   \"erasure\"]\n ]\n install: [make \"-C\" \"erasure\" \"install\"]\n \
197   \n dev-repo: \"git+https://github.com/MetaCoq/metacoq.git#coq-8.11\"\n \

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198   \ url {\n   src:\n
↳  \ "git+file:///home/whenderson/projects/PEARLS/repos_full/certicoq/submodules/metacoq#HEAD"\n
199   \n } \n}"
200   - - coq-metacoq-pcuic
201   - "{\n opam-version: \"2.0\"\n version: \"8.14.dev\"\n synopsis: \"A type\
202   \ system equivalent to Coq's and its metatheory\"\n description: \"\"\n\"
203   \nMetaCoq is a meta-programming framework for Coq.\n\nThe PCUIC module provides\
204   \ a cleaned-up specification of Coq's typing algorithm along\nwith a certified\
205   \ typechecker for it. This module includes the standard metatheory of\n
206   PCUIC: Weakening, Substitution, Confluence and Subject Reduction are proven\
207   \ here.\"\n\" \n maintainer: \"matthieu.sozeau@inria.fr\"\n authors: [\n
208   \   \"Abhishek Anand <aa755@cs.cornell.edu>\"\n   \"Simon Boulier <simon.boulier@inria.fr>\"\n
209   \   \"Cyril Cohen <cyril.cohen@inria.fr>\"\n   \"Yannick Forster <forster@ps.uni-saarland.de>\"\n
210   \   \"Fabian Kunze <fkunze@fakusb.de>\"\n   \"Gregory Malecha <gmalecha@gmail.com>\"\n
211   \   \"Matthieu Sozeau <matthieu.sozeau@inria.fr>\"\n   \"Nicolas Tabareau\
212   \ <nicolas.tabareau@inria.fr>\"\n   \"Th\xE9o Winterhalter <theo.winterhalter@inria.fr>\"\n
213   \ ]\n license: \"MIT\"\n homepage: \"https://metacoq.github.io/metacoq\"\n
214   \n bug-reports: \"https://github.com/MetaCoq/metacoq/issues\"\n depends:\
215   \ [\n   \"coq-equations\" {>= \"1.3\"}\n   \"coq-metacoq-template\" {=\
216   \ version}\n ]\n build: [\n   [\"sh\" \"/configure.sh\"]\n   [make\
217   \ \"-j\" \"%{jobs}%\" \"-C\" \"pcuic\"]\n ]\n install: [make \"-C\" \"\
218   pcuic\" \"install\"]\n dev-repo: \"git+https://github.com/MetaCoq/metacoq.git#coq-8.11\"\n
219   \n url {\n   src:\n
↳  \ "git+file:///home/whenderson/projects/PEARLS/repos_full/certicoq/submodules/metacoq#HEAD"\n
220   \n } \n}"
221   - - coq-metacoq-safechecker
222   - "{\n opam-version: \"2.0\"\n version: \"8.14.dev\"\n synopsis:\n   \"\
223   Implementation and verification of safe conversion and typechecking algorithms\
224   \ for Coq\"\n description: \"\"\n\" \nMetaCoq is a meta-programming framework\
225   \ for Coq.\n\nThe SafeChecker modules provides a correct implementation\
226   \ of\nweak-head reduction, conversion and typechecking of Coq definitions\
227   \ and global environments.\"\n\" \n maintainer: \"matthieu.sozeau@inria.fr\"\n
228   \n authors: [\n   \"Abhishek Anand <aa755@cs.cornell.edu>\"\n   \"Simon\
229   \ Boulier <simon.boulier@inria.fr>\"\n   \"Cyril Cohen <cyril.cohen@inria.fr>\"\n
230   \   \"Yannick Forster <forster@ps.uni-saarland.de>\"\n   \"Fabian Kunze\
231   \ <fkunze@fakusb.de>\"\n   \"Gregory Malecha <gmalecha@gmail.com>\"\n   \
232   \"Matthieu Sozeau <matthieu.sozeau@inria.fr>\"\n   \"Nicolas Tabareau\
233   \ <nicolas.tabareau@inria.fr>\"\n   \"Th\xE9o Winterhalter <theo.winterhalter@inria.fr>\"\n
234   \ ]\n license: \"MIT\"\n homepage: \"https://metacoq.github.io/metacoq\"\n
235   \n bug-reports: \"https://github.com/MetaCoq/metacoq/issues\"\n depends:\
236   \ [\n   \"coq-metacoq-pcuic\" {= version}\n ]\n build: [\n   [\"sh\" \
237   \ \"/configure.sh\"]\n   [make \"-j\" \"%{jobs}%\" \"-C\" \"safechecker\"\
238   \ ]\n ]\n install: [make \"-C\" \"safechecker\" \"install\"]\n dev-repo:\
239   \ \"git+https://github.com/MetaCoq/metacoq.git#coq-8.11\"\n url {\n   \
240   \ src:\n
↳  \ "git+file:///home/whenderson/projects/PEARLS/repos_full/certicoq/submodules/metacoq#HEAD"\n
241   \n } \n}"
242   - - coq-metacoq-template
243   - "{\n opam-version: \"2.0\"\n version: \"8.14.dev\"\n synopsis: \"A quoting\
244   \ and unquoting library for Coq in Coq\"\n description: \"\"\n\" \nMetaCoq\
245   \ is a meta-programming framework for Coq.\n\nTemplate Coq is a quoting\
246   \ library for Coq. It takes Coq terms and\nconstructs a representation of\
247   \ their syntax tree as a Coq inductive data\ntype. The representation is\
248   \ based on the kernel's term representation.\n\nIn addition to a complete\
249   \ reification and denotation of CIC terms,\nTemplate Coq includes:\n\n-\
250   \ Reification of the environment structures, for constant and inductive\
251   \ declarations.\n- Denotation of terms and global declarations\n- A monad\
252   \ for manipulating global declarations, calling the type\n checker, and\
253   \ inserting them in the global environment, in the style of\n MetaCoq/MTac.\"\n
254   \n\" \n maintainer: \"matthieu.sozeau@inria.fr\"\n authors: [\n   \"Abhishek\
255   \ Anand <aa755@cs.cornell.edu>\"\n   \"Simon Boulier <simon.boulier@inria.fr>\"\n
256   \   \"Cyril Cohen <cyril.cohen@inria.fr>\"\n   \"Yannick Forster <forster@ps.uni-saarland.de>\"\n
257   \   \"Fabian Kunze <fkunze@fakusb.de>\"\n   \"Gregory Malecha <gmalecha@gmail.com>\"\n
258   \   \"Matthieu Sozeau <matthieu.sozeau@inria.fr>\"\n   \"Nicolas Tabareau\
259   \ <nicolas.tabareau@inria.fr>\"\n   \"Th\xE9o Winterhalter <theo.winterhalter@inria.fr>\"\n
260   \ ]\n license: \"MIT\"\n homepage: \"https://metacoq.github.io/metacoq\"\n
261   \n bug-reports: \"https://github.com/MetaCoq/metacoq/issues\"\n depends:\
262   \ [\n   \"ocaml\" {>= \"4.07.1\"}\n   \"coq\" {>= \"8.14\" & < \"8.15~\"}

```

```

263     } \n    \"coq-equations\" {>= \"1.3\"} \n ] \n build: [ \n    [\"sh\" \"../configure.sh\" \
264     ] \n    [make \"-j\" \"{%jobs}%\" \"template-coq\"] \n ] \n install: [make \
265     \ \"-C\" \"template-coq\" \"install\"] \n dev-repo:
↳  \ "git+https://github.com/MetaCoq/metacoq.git#master\" \
266     \n url { \n    src: \n
↳  \ "git+file:///home/whenderson/projects/PEARLS/repos_full/certicoq/submodules/metacoq#HEAD\" \
267     \n } \n ] \"
268     - - coq-metacoq-translations
269     - \"{ \n    opam-version: \"2.0\" \n    version: \"8.14.dev\" \n    synopsis: \"Translations \
270     \ built on top of MetaCoq\" \n    description: \"\ \" \n MetaCoq is a meta-programming \
271     \ framework for Coq. \n \n The Translations modules provides implementation \
272     \ of standard translations \n from type theory to type theory, e.g. parametricity \
273     \ and the `cross-bool` \n translation that invalidates functional extensionality. \n \" \
274     \ \" \n    maintainer: \"matthieu.sozeau@inria.fr\" \n    authors: [ \n    \"Simon \
275     \ Boulrier <simon.boulrier@inria.fr>\" \n    \"Cyril Cohen <cyril.cohen@inria.fr>\" \n
276     \n    \"Matthieu Sozeau <matthieu.sozeau@inria.fr>\" \n    \"Nicolas Tabareau \
277     \ <nicolas.tabareau@inria.fr>\" \n    \"Th\xE9o Winterhalter <theo.winterhalter@inria.fr>\" \n
278     \n ] \n    license: \"MIT\" \n    homepage: \"https://metacoq.github.io/metacoq\" \n
279     \n    bug-reports: \"https://github.com/MetaCoq/metacoq/issues\" \n    depends: \
280     \ [ \n    \"coq-metacoq-template\" {= version} \n ] \n    build: [ \n    [\" \
281     sh\" \"../configure.sh\"] \n    [make \"-j\" \"{%jobs}%\" \"-C\" \"translations\" \
282     ] \n ] \n    install: [make \"-C\" \"translations\" \"install\"] \n    dev-repo: \
283     \ \"git+https://github.com/MetaCoq/metacoq.git#coq-8.11\" \n    url { \n    \
284     \ src: \n
↳  \ "git+file:///home/whenderson/projects/PEARLS/repos_full/certicoq/submodules/metacoq#HEAD\" \
285     \n } \n ] \n ] \"
286     pinned:
287     - - coq
288     - prism.util.opam.version,OCamlVersion,8.10.2
289     - - coq-certicoq
290     - prism.util.opam.version,OCamlVersion,0.9~beta+8.14
291     - - coq-metacoq
292     - prism.util.opam.version,OpamVersion,8.14.dev
293     - - coq-metacoq-erasure
294     - prism.util.opam.version,OpamVersion,8.14.dev
295     - - coq-metacoq-pcuic
296     - prism.util.opam.version,OpamVersion,8.14.dev
297     - - coq-metacoq-safechecker
298     - prism.util.opam.version,OpamVersion,8.14.dev
299     - - coq-metacoq-template
300     - prism.util.opam.version,OpamVersion,8.14.dev
301     - - coq-metacoq-translations
302     - prism.util.opam.version,OpamVersion,8.14.dev
303     - - coq-serapi
304     - prism.util.opam.version,OCamlVersion,8.10.0+0.7.2
305     roots:
306     - - coq
307     - prism.util.opam.version,OCamlVersion,8.10.2
308     - - coq-serapi
309     - prism.util.opam.version,OCamlVersion,8.10.0+0.7.2
310     - - ocaml-base-compiler
311     - prism.util.opam.version,OCamlVersion,4.09.1
312     offset: null
313     project_state: bda0bc601a038ba6b65da2e3c52cc02c4d910f35
314     project_name: hoare-tut
315     tags:
316     - VernacStartTheoremProof
317 repaired_state_or_diff:
318     diff:
319     text: 'diff --git a/exgcd.v b/exgcd.v
320
321     index fe1ae41..91f7b60 100644
322
323     --- a/exgcd.v
324
325     +++ b/exgcd.v
326
327     @@ -144,+143,0 @@ Hint Resolve Zneq_bool_true Zneq_bool_false Zle_bool_imp_le

```

```
328     Zis_gcd_intro: zarith
329     -
330
331
332     @@ -159 +158 @@ intuition auto with zarith.
333
334     -cutrewrite <- ((fst e'')=(snd e'')) in H; auto with zarith.
335
336     +replace (snd e'') with (fst e'') in H; auto with zarith.
337
338     @@ -163,0 +163 @@ Qed.
339
340     +
341     '
342
343     environment: null
```