

Advance Care Planning CDA Implementation Guide

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Document Information

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1.0	21 Dec 2017	Initial public release. This specification is published to support the My Health Record advance care planning document (2016).
2.0.0	NaN NaN	This version implements terminology updates and transitions from openEHR based models to FHIR-based models. This is a backwards incompatible release

Related Documents

Name	Version/Release Date
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Common - Clinical Document	Version 1.5.2, Issued 28 February 2019
CDA Rendering Specification	Version 1.0, Issued 07 March 2012
My Health Record Advance Care Planning Information Requirements	Version 1.0, Not published
HL7 Clinical Document Architecture	Release 2, January 2010
Representing Coding in CDA Documents Implementation Guidance	Version 1.0, Issued 10 October 2011
Clinical Documents Common Conformance Profile	Version 1.7, Issued 21 December 2017
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1 Introduction

This implementation guide is an *HL7 Clinical Document Architecture* [*HL7CDAR2*] specification to represent a Advance Care Planning. Advance Care Planning is a copy of a statement of an individual's decisions about their future care, should they become incapable of participating in medical treatment decisions.

1.1 Document purpose and scope

The primary aim of the implementation guide is to take implementers step by step through mapping each element of the Advance Care Planning (ACP) model (*Advance Care Records FHIR Implementation Guide [DH2020h]*) to a corresponding CDA attribute or element. The resulting CDA document can be used for the electronic exchange of ACP information between healthcare providers.

This implementation guide is not to be used as a guide to presentation (or rendering) of the data. Beyond defining conformance requirements on CDA narratives it contains no information as to how the data described by it should be displayed and no such guidance should be inferred from This implementation guide.

Reference has been made to International and Australian Standards, and to Standards from Health Level Seven. The following standard is referred to in the text in such a way that some or all of its content constitutes requirements for the purposes of this specification: *HL7 Clinical Document Architecture* [*HL7CDAR2*].

Wherever possible, material in this specification is based on existing standards. All efforts have been made to minimise divergence from the HL7 Australia profiles of HL7 International standards (*Australian Base Implementation Guide (AU Base 1.1.1) [HL7AUF3B2]*) to provide for system interoperability and compatibility with other profiles. Issues of an editorial nature in the source material (such as spelling or punctuation errors) are intentionally reproduced.

1.2 Context and use

A CDA implementation guide is part of a package of documents and files that support the development of software to exchange a type of clinical document, an end-product clinical specification package.

An Agency end-product clinical specification package supports software developers to create and interpret instances of a clinical document. The core of each package is a specification of the information content of instances of the clinical document.

Supplementary contents of the package include statements of scenarios for which the specification is appropriate, guidance on implementing the specification, and guidance on testing purported instances.

The contents may include:

- · statement of requirements
- CDA implementation guide a statement of constraints and custom extensions on *HL7 Clinical Document Architecture* [HL7CDAR2]
- FHIR implementation guide a statement of constraints and custom extensions on FHIR Release 3 (STU) [HL7FHIR3]
- template package library a set of Schematron schema to test conformance of CDA documents with the specification
- conformance profile a statement of conformance requirements for exchanging documents within a particular scenario such as the My Health Record
- release notes

Clinical specification packages contain only files relevant to the particular clinical document. Specifications that are common to many clinical documents and should be considered part of the specification package, as directed by the relevant release note and conformance profile, are contained in the *Common - Clinical Document [DH2019a]*.

1.3 How to read this document

This implementation guide contains descriptions of both constraints on HL7 CDA and, where necessary, custom extensions to the HL7 CDA, for the purposes of fulfilling the requirements for Australian implementations of advance care planning documents. These constraints are defined as a set of templates.

For implementers, the starting point for the CDA templates is Composition (Advance Care Planning), which references the additional templates necessary to assert conformance for this implementation guide.

Chapters that may be of primary interest are organised as follow:

- 3 *Conformance* defines the conformance requirements applicable to a clinical document instance claiming conformance to a ClinicalDocument template defined in this implementation guide or any derived conformance profile.
- 4 Advance Care Planning hierarchy hierarchical overview of the model for this document-level usage scenario.
- 5 CDA Header templates contains the CDA Header templates that apply across all of the supported usage scenarios in this implementation guide.
- 6 Document CDA templates defines the ClinicalDocument template for each logical model of a document-level usage scenario, e.g. Advance Care Planning, in this implementation guide.
- 7 Section CDA templates defines the section templates referenced by a ClinicalDocument template in this implementation guide.
- 8 Participation CDA templates defines the templates for individuals and organisations, called participations, referenced by other templates in this implementation guide.
- 9 Entity CDA templates defines the templates for entities referenced by a participation template in this implementation guide.
- 10 Act CDA templates defines the templates for entry-level classes, called acts, referenced by other templates in this implementation guide.
- Appendix B, *Examples* provides examples demonstrating a document-level usage model, e.g. Advance Care Planning, and that conform to the CDA templates defined in this implementation guide.

1.4 Editorial note

This implementation guide is an early working specification that is available for comment and review. It may be used to solicit feedback and to provide insight as to the expected content in a forthcoming stable and approved version of the specification.

This implementation guide may not considered to be complete enough or sufficiently reviewed to be safe for implementation and use in production systems. It may have known issues and still be in development.

It is intended to supersede Advance Care Information Structured Content Specification [DH2017e] and Advance Care Information CDA Implementation Guide [DH2017f]. This new, backwards incompatible version, is intended to address alignment to HL7 FHIR and is the result of work undertaken in conjunction with HL7 Australia.

1.5 Intended audience

This implementation guide is aimed at software development teams, architects, designers, clinicians and informatics researchers who are responsible for the delivery of clinical applications, infrastructure components and messaging interfaces, and also for those who wish to evaluate the clinical suitability of the Agency-endorsed specifications.

This implementation guide and related artefacts are technical in nature and the audience is expected to be familiar with the language of health data specifications and to have some familiarity with health information standards and specifications, such

as *HL7 Clinical Document Architecture* [*HL7CDAR2*] and Standards Australia IT-014 documents. Definitions and examples are provided to clarify relevant terminology usage and intent.

1.6 Known issues

This section lists known issues with this specification at the time of publishing. We are working on solutions to these issues and encourage comments to help us develop these solutions.

Reference	Description
Placeholder logical type icons	There is ongoing discussion on the use of icons as a visual aid denoting different logical types in a hierarchical view in implementation guides.
	Feedback on the work in progress FHIR-driven CDA implementation guides has included consistent feedback that a logical hierarchy with icons was a key piece of informative material – the old NEHTA developed logical data types had their own icons, FHIR does not provide a similar type of icons for its types so this would need to be a piece of work to develop a set of meaningful icons to be used in a FHIR logical hierarchy in the CDA implementation guides.
	In the interim a placeholder set of icons from the <u>Digital Health Icon Library v1.0</u> have been used in this implementation guide (and some others) to elicit further feedback and provide a baseline from which a useful set of icons may be developed.
Source material errors	Material in this specification is based on existing standards and all efforts have been made to minimise divergence. Issues of an editorial nature in the source material (such as spelling or punctuation errors in an element description) are intentionally reproduced.
Advance Care Planning CDA implementation guide roadmap	The objective of this specification is to provide guidance on the implementation in HL7 CDA Release 2 of advance care planning documents (defined in HL7 FHIR).
	The current guide covers implementation in HL7 CDA Release 2 of the advance care planning model defined in FHIR Release 3 (STU) (<i>Advance Care Records FHIR Implementation Guide [DH2020h]</i>).
	The model is in transition to a FHIR Release 4 representation in collaboration with HL7 Australia. This move has normative implications to the CDA representation that are expected to result in major version incrementation to accommodate backwards incompatible changes. Widespread changes to terminology, including code system and value set identifiers, are expected to make up the bulk of the backwards incompatible changes. Where possible, FHIR Release 4 terminology has been pre-adopted in this implementation guide.
	Future releases of this implementation guide are also expected to provide support for additional advance care plan usage scenarios.
PractitionerRole > healthcareService	PractitionerRole > healthcareService is not currently mapped into CDA. Future releases of this implementation guide are expected to include a CDA template for the concept of a <u>HealthcareService</u> .
Resolving URLs to Agency logical models (FHIR profiles) – not avail- able	Direct links to the Agency logical models (published as FHIR profiles) referenced throughout this implementation guide are not available. It is intended that logical models, e.g. "Patient with Mandatory Identifier", will be published at a resolvable address. Future releases of this implementation guide are expected to hyperlink all references to logical models.
	At this time the Agency logical models are only available via the Advance Care Records FHIR Implementation Guide [DH2020h].
Appendix B. Examples	Alignment with examples between the CDA-IG and FHIR-IG is not yet complete.



2 Guidance

2.1 Clinical Document Architecture Release 2

A CDA document is an XML document built following the rules described in the CDA specification, which conforms to the HL7 CDA schema provided by HL7. The CDA document is based on the semantics provided by the HL7 V3 RIM, Data types and Vocabulary standards [HL7V3].

A CDA document has two main parts: the header and the body.

The CDA document header is consistent across all CDA documents, regardless of document type. The header identifies and classifies the document and provides information on authentication, the encounter, the patient, and the involved providers.

The body contains the clinical report. The body can be marked-up text (narrative, renderable text) or a combination of both marked-up text and structured data. The marked-up text can be transformed to XHTML and displayed to a human. The structured data allows machine processing of the information shown in the narrative section.

All clinical information is required to be marked up in CDA narratives. These narratives are CDA-defined hypertext, able to be rendered in web browsers with only a standard accompanying transformation. This transformation is produced and distributed by HL7.

The rendered narrative can stand alone as a source of authenticated information for consuming parties. Content from the CDA body is not to be omitted from the narrative.

Further information and conformance requirements on the CDA narrative is available in CDA narrative conformance requirements.

The following references are recommended to gain a better understanding of CDA:

- HL7 Clinical Document Architecture [HL7CDAR2]
- HL7 Version 3 Standard [HL7V3]
- CDA Examples [RING2009]
- CDA Validation Tools: infoway_release_2_2X_18.zip [INFO2009]

2.2 Australian Digital Health Agency CDA extensions

As part of the CDA, standard extensions are allowed as follows:

Locally-defined markup may be used when local semantics have no corresponding representation in the CDA specification. CDA seeks to standardize the highest level of shared meaning while providing a clean and standard mechanism for tagging meaning that is not shared. In order to support local extensibility requirements, it is permitted to include additional XML elements and attributes that are not included in the CDA schema. These extensions should not change the meaning of any of the standard data items, and receivers must be able to safely ignore these elements. Document recipients must be able to faithfully render the CDA document while ignoring extensions.

Extensions may be included in the instance in a namespace other than the HL7v3 namespace, but must not be included within an element of type ED (e.g., <text> within <procedure>) since the contents of an ED datatype within the conformant document may be in a different namespace. Since all conformant content (outside of elements of type ED) is in the HL7 namespace, the sender can put any extension content into a foreign namespace (any namespace other than the HL7 namespace). Receiving systems must not report an error if such extensions are present. HL7 Clinical Document Architecture [HL7CDAR2]

A number of extensions to CDA have been defined in this implementation guide. To maintain consistency, the same development paradigm has been used as CDA.

These Australian Digital Health Agency CDA extensions have been added to the Australian Digital Health Agency CDA schema and are incorporated in the namespace http://ns.electronichealth.net.au/Ci/Cda/Extensions/3.0 as shown in Appendix B, Examples. Future versions of CDA extensions will be versioned as per the following example:

http://ns.electronichealth.net.au/Ci/Cda/Extensions/4.0

The Australian Digital Health Agency CDA schema therefore differs from the base HL7 CDA W3C XML schema (referred to in this implementation guide as the HL7 CDA schema). CDA documents which include extensions will fail to validate against the HL7 CDA schema – this is a known limitation.

An advance care planning document that conforms to this specification will validate against the Australian Digital Health Agency CDA schema that accompanies this specification, and will validate against the HL7 CDA schema once the extensions have been removed. Note that merely passing schema validation does not ensure conformance. For more information, refer to Base conformance requirements.

2.3 Conformance conventions

This implementation guide specifies the CDA templates for implementing a advance care planning. A CDA template is a set of constraints, and where necessary, custom extensions to *HL7 Clinical Document Architecture [HL7CDAR2]*, expressed using conformance conventions as defined in this implementation guide.

CDA templates are presented in a CDA mapping table (see Mapping presentation and structure) and indicated by the presence of a templateId (see Template identifiers).

2.3.1 Template identifiers

Template identifiers (templateId) are unique to each CDA template. When valued in an instance, the template identifier signals the assertion of conformance to a set of template-defined constraints. The root value of this element (e.g. @root="1.2.36.1.2001.1001.1001.1002.226") provides a unique identifier for the template in question.

The following example demonstrates assertion of conformance to two CDA templates. This use of templateId indicates that the CDA instance not only conforms to the CDA specification, but in addition, conforms to two templates.

Example 2.1. Use of templated to assert conformance to two CDA templates

2.3.2 Open and closed templates

A CDA template may be either an open template or a closed template:

- In an open template all of the features of the CDA R2 base specification [HL7CDAR2] are allowed except as constrained by explicitly specified constraints.
- In a closed template everything that is allowed must be explicitly specified and nothing further may be allowed.

The template context in this implementation guide is that of an open template unless otherwise stated. A closed template is indicated by the presence of the following constraint:

This template SHALL be a closed template

For example if a CDA template says nothing about the use of the id element:

- In an open template context this means that id is allowed as specified in the schema
- In a closed template context this means that no use of id is allowed

Example 2.2. CDA mapping fragment - Interpreting an open template for logical elements

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments	
CDA Header Data Elements				Context: /		
Composition	A clinical document written by the nominated provider, which contains key pieces of information about an individual's health status and is useful to a wide range of providers in assessing individuals and delivering care.	0*	Composition	ClinicalDocument	In CDA the maximum occurrences of ClinicalDocument is 1. Although the model indicates that Composition is 0*, in a CDA implementation this is limited to 01. In addition to the template defined in this mapping table, ClinicalDocument SHALL conform to the template defined in ClinicalDocument.	
				ClinicalDocument/templateId	The use of templateld signals the imposition of a set of	
				ClinicalDocument/templateId/@root="1.2.36.1.2001.1001.102.101.100020"	template-defined constraints.	
Composition > section (Event	Summary information concerning the event.	11	BackboneElement	ClinicalDocument/component/structuredBody/component[event]		
Overview)				ClinicalDocument/component/structuredBody/component[event]/section	section SHALL conform to the template defined in section (Event Overview).	
Composition > section (Allergies)	Information about allergies or intolerances identified or re-	01	BackboneElement	ClinicalDocument/component/structuredBody/component[allergy]		
	ported during this encounter. This may include statements that a patient does not have an allergy or category of allergies.			ClinicalDocument/component/structuredBody/component[allergy]/section	section SHALL conform to the template defined in section (Allergies).	

The above template fragment states that each instance of the logical element Composition is represented as a ClinicalDocument that:

- explicitly requires an instance of templateId with a root that conforms to the fixed value constraint and an instance of extension that conforms to the fixed value constraint. Other attributes of templateId, e.g. assigningAuthorityName, are implicitly allowed.
- implicitly allows any other child attributes or elements of ClinicalDocument including other instances of templateId.
- explicitly requires exactly one component with an instance of section that conforms to section (Event Overview) [templateld: 1.2.36.1.2001.1001.102.101.100059]. Other component elements or attributes are implicitly allowed.
- explicitly allows at most one component with an instance of section that conforms to section (Allergies) [templateId: 1.2.36.1.2001.1001.102.101.100069]. Other component elements or attributes are implicitly allowed.
- implicitly allows one or more instances of a component with a section that does not conform to either section (Event Overview) [templateld: 1.2.36.1.2001.1001.102.101.100059] or section (Allergies) [templated: 1.2.36.1.2001.1001.102.101.100069].

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2.3.3 Fixed value constraint

A fixed value constraint is used to bind the value of an element or attribute to the exact string as presented between the quote marks (i.e. "FIXED_VALUE"). This type of constraint is frequently used in a template to cast an element to a particular data type, or bind an element of type Coded Simple (CS) to a single code, or fix an attribute of a primitive type to a value.

A fixed value constraint in the "CDA schema element" column of a CDA mapping table will use XPath like notation, for example:

/ClinicalDocument/confidentialityCode/@nullFlavor="N/A"

The use of "=" is to be interpreted as SHALL. The above example specifies a conformance requirement that the nullFlavor attribute SHALL be instantiated as "N/A".

A fixed value constraint in the "CDA constraints and comments" column of a CDA mapping table will make use of Conformance verbs, for example:

displayName SHOULD be "Closing the Gap Copayment Eligibility Indicator"

2.3.4 XPath like notation

This implementation guide uses an XML Path Language (XPath) like notation to identify the CDA schema element(s) to which conformance requirements are applied.

This notation provides a mechanism that will be familiar to developers for identifying parts of an XML document. XPath syntax selects nodes from an XML document using a path containing the context of the node(s). The path is constructed from node names and attribute names (prefixed by a "@") and catenated with a "/" symbol. In addition an [index] is used to differentiate similar mappings e.g. participant[location] and participant[author].

The syntax is: {/name{[index]}}n

Where:

- {} indicates optional
- {}n means a section that may repeat
- [index] differentiates two similar mappings and indicates that a pattern 'like this' is to be applied (see Interpreting cardinality in a CDA mapping table for logical elements)

An index after the name, such as component[admin_obs] or entry[close_gap] implies that there are expected to be two or more different component elements and entry elements instantiated in the ClinicalDocument instance. The indexes differentiate which CDA schema element is referenced in the path.

The value attribute of the value element from the below example could be referred to with the path /ClinicalDocument/component/structuredBody/component[admin_obs]/section/entry[close_gap]/observation/value/@value.

Example 2.3. XPath like notation

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The corresponding entries in the CDA schema element column of a CDA mapping table for /ClinicalDocument/component/structuredBody/component[admin_obs]/section/entry[close_gap]/observation/value could be expressed using the XPath like notation as in the template fragment below.

Example 2.4. CDA mapping fragment - XPath like notation

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
CDA Header Data Elements				Context: /ClinicalDocument/component/structuredBody/component[admin_obs]/	section
Patient > closing-the-gap-registration	Indication for eligibility for the Closing the Gap program.	01	<u>boolean</u>	entry[close_gap]	The containing component[admin_obs]/section SHALL conform to the template defined in component (Administrative Observations).
				entry[close_gap]/observation	
				entry[close_gap]/observation/@classCode="OBS"	
				entry[close_gap]/observation/@moodCode="EVN"	
				entry[close_gap]/observation/ code	
				entry[close_gap]/observation/code/@code="103.32011"	
				entry[close_gap]/observation/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components
				entry[close_gap]/observation/code/@displayName	displayName SHOULD be "Closing the Gap Copayment Eligibility Indicator".
				entry[close_gap]/observation/value	closing-the-gap-registration is "true" if eligible for Closing the Gap co- payment.
					value/@xsi:type SHALL be "BL".

2.3.5 Terminology binding

Vocabulary is specified in this implementation guide as:

- Fixed value constraint if only one permissible value is allowed, or
- Binding to a value set if more than one permissible value is allowed, e.g. Medication Act Status HL7 v3 (required)

Where used in this implementation guide, binding strengths are hyperlinked to their normative definition. An excerpt is provided in the below table for ease of use, where there are conflicts the target normative definition in FHIR Release 3 (STU) [HL7FHIR3] applies.

Binding strength	Description
required	To be conformant, codes in this element SHALL be from the specified value set.
extensible	To be conformant, codes in this element SHALL be from the specified value set if any of the codes within the value set can apply to the concept being communicated.
preferred	Instances are encouraged to draw from the specified codes for interoperability purposes but are not required to do so to be considered conformant.
example	Instances are not expected or even encouraged to draw from the specified value set. The value set merely provides examples of the types of concepts intended to be included.

Terminology binding notation

A value set binding will be specified in the "CDA constraints and comments" column of a CDA mapping table as the title of the value set (hyperlinked to its definition) followed by identification of the binding strength (hyperlinked to its definition). For example:

Encounter Act Status HL7 v3 (required)

In simple terms the above required binding indicates that the CDA schema element SHALL be valued with one of the codes from that value set. However valuing of an element in CDA is always in the context of the data type and the code system specification (e.g. case sensitive or version required).

Example of interpreting a required terminology binding on an element of type Coded Simple Value (CS)

A Coded Simple Value data type, or CS is defined in the HL7 V3 Data types standards [HL7V3]. It is the simplest form of coded data and consists only of a code, other attributes are prohibited. The code system and code system version are fixed by the context in which CS value occurs. Common instances typed as CS include statusCode, @classCode, @moodCode, and @nullFlavor which have HL7-defined value sets.

For example, Encounter Act Status HL7 v3 (required), applied to a encounter/statusCode element is to be interpreted as:

- statusCode/@code SHALL be present and SHALL contain a code from Encounter Act Status HL7 v3
- statusCode/@nullFlavor SHALL NOT be present as no meaningful value can be supplied
- no other attributes can be supplied as encounter/statusCode is of type Coded Simple (CS) which prohibits additional attributes

Example 2.5. Interpreting required value set binding

<statusCode code="active" />

Example of interpreting a required terminology binding on an element of type Concept Descriptor (CD)

A Concept Descriptor data type, or CD, is defined in the HL7 V3 Data types standards [HL7V3]. It is a reference to a concept defined in a code system. Common instances typed as CD include code, and value when typed to CD.

For example, Encounter Act Status HL7 v3 (required) applied to an observation/code is to be interpreted as:

- code/@code SHALL be present and SHALL contain a code from Encounter Act Status HL7 v3
- code/@codeSystem="2.16.840.1.113883.5.14" **SHALL** be present
- code/@nullFlavor **SHALL NOT** be present as no meaningful value can be supplied
- $\bullet \verb| code/@displayName| \textbf{SHOULD}| be present and \verb| SHOULD| contain the display| associated with the selected code from the value set \\$
- code/@codeSystemName SHOULD be present and SHOULD contain the display associated with the code system as it is registered with a registration authority such as HL7
- code/@originalText SHOULD be present and SHALL carry the full text associated with this code as selected by, typed by, or displayed to the author
- code/@qualifier **SHALL NOT** be present as the example code system does not define qualifier values

• code/@translation MAY be present if an alternative terminology is in use in the sending system and a translation is available

Example 2.6. Interpreting required value set binding

```
<code code="active" codeSystem="2.16.840.1.113883.5.14" />
<!-- or -->
<code code="active" codeSystem="2.16.840.1.113883.5.14"</pre>
codeSystemName="v3.ActStatus" displayName="active"/>
<!-- or -->
<code code="active" codeSystem="2.16.840.1.113883.5.14"</pre>
codeSystemName="v3.ActStatus" displayName="active">
  <originalText>Active</originalText>
</code>
```

2.3.6 Conformance verbs

Where used in this implementation guide, the keywords **SHALL**, **SHOULD**, **MAY**, **SHALL NOT** and **SHOULD NOT** from *Key Words for Use in RFCs to Indicate Requirement Levels [RFC2119]* are to be interpreted as described in the table below.

Conformance verb	Interpretation
SHALL	An absolute requirement.
	Where SHALL appears in any conformance constraint it indicates a mandatory requirement.
	Where SHALL is applied to the occurrences of an element or attribute then that element or attribute must be present but can be null if the value is not known and the value has not been constrained to not allow a null value.
SHOULD	A requirement that is considered best practice or recommendation for inclusion. There may be valid reasons to ignore an item, but the full implications must be understood and carefully weighed before choosing a different course.
	Where SHOULD appears in a conformance constraint that constrains the allowed occurrences of an item it indicates that the item may not be present but does not override the upper bound of the cardinality range.
	For a sending application where SHOULD is applied to the occurrences of an item then that item must be present if a sending application has the data for that data element. If the value is not known the element or attribute does not need to be included.
	Implementers must support an optional requirement.
MAY	A requirement that can be included or omitted as the author decides with no implications.
	Where MAY appears in a conformance constraint that constrains the allowed occurrences of an item it indicates that the item may not be present but does not override the upper bound of the cardinality range.
	Implementers must support an optional requirement.
SHALL NOT	An absolute prohibition.
	Where SHALL NOT appears in any conformance constraint it indicates a mandatory prohibition requirement.

Conformance verb	Interpretation
SHOULD NOT	A requirement that is considered best practice or recommendation against inclusion. There may be valid reasons to ignore an item, but the full implications must be understood and carefully weighed before choosing a different course.
	Where SHOULD NOT appears in a conformance constraint that constrains the allowed occurrences of an item it indicates that the item may not be present but does not override the upper bound of the cardinality range.
	For a sending application where SHOULD NOT is applied to the occurrences of an item then that element or attribute must be present if a sending application has the data for that data element. If the value is not known the element or attribute does not need to be included.
	Implementers must support an optional requirement.

2.3.7 Cardinality notation

The cardinality range specifies the allowable occurrences in the format "m..n" where m is the minimum allowed members of the set (lower bound) and n is the maximum allowed members of the set (upper bound). The allowed values for m and n are 0, any positive integer, and *.

The table below demonstrates a representative set of examples of cardinality range and how to interpret that cardinality range; p is positive integer greater than the minimum allowed members of the set.

Cardinality range	Interpretation
00	zero (explicitly prohibited)
01	zero or one
11	exactly one
0*	zero or more
1*	at least one
2*	at least two
1p	at least one and not more than p
2p	at least two and not more than p

2.3.8 Interpreting cardinality in a CDA mapping table for logical elements

A CDA mapping table for logical elements will include a logical cardinality range for each logical element and a series of CDA schema elements that when instantiated are considered to be the CDA representation of that logical element.

In order to instantiate a logical element all CDA schema elements mapped to that logical element are to be instantiated unless a constraint is present in the mapping table to indicate otherwise. This means that while the first CDA schema element in a series has a comparative relationship to the logical cardinality, the effect on the additional CDA schema elements in a series is always that their minimum occurrence is to be interpreted as 1.

The logical cardinality is applied to the first mapped CDA schema element in a series in the following manner:

- The most strict minimum occurrence between the logical cardinality or the CDA schema cardinality is applied.
 - o If a logical element has a minimum cardinality of 1 and the mapped CDA schema element has a minimum cardinality of 0 then the most strict cardinality of 1 applies to that CDA schema element.
- A CDA schema element with an [index] (see XPath like notation), e.g. representedOrganization/name[business], has the maximum occurrence of the logical element applied as a pattern 'like this'.
 - o For example, if the logical cardinality of Organization > name is 0..1 and that logical element is mapped to representedOrganization/name[business]="TestOrg" (CDA schema cardinality of 0..*), then a maximum of one instance of representedOrganization/name that has a value of "TestOrg" may be present. Other instances of representedOrganization/name that do not meet the pattern of "TestOrg" may be present.
- A CDA schema element with no [index] (see XPath like notation), e.g. representedOrganization/name, has the most strict maximum occurrence between the logical cardinality or the CDA schema cardinality applied.
 - o For example, if the logical cardinality of Organization > name is 0..1 and that logical element is mapped to representedOrganization/name (CDA schema cardinality of 0..*), then the most strict cardinality of 1 applies to that CDA schema element.

Example 2.7. CDA mapping fragment - Interpreting cardinality in a CDA mapping table for logical elements

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments	
CDA Body Level 3 Data Elements				Context: Comes from linking elements		
section	A set of allergies or intolerances that have been categorised as critical.	gies or intolerances that have been categorised as Cardinality comes from linking element	n	section	section/@nullFlavor SHALL NOT be present.	
				section/templateId		
				section/templateId/@root="1.2.36.1.2001.1001.102.101.100092"		

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
section > title	The label for this particular section. This will be part of the rendered content for the document, and is often used to build a table of contents.	11	string	section/title	
section > code	A code identifying the kind of content contained within the section. This must be consistent with the section title.	11	CodeableConcept	section/code	
				section/code/@code="48765-2"	
				section/code/@codeSystem="2.16.840.1.113883.6.1"	LOINC
				section/code/@displayName	displayName SHOULD be "Allergies ∨ adverse reactions".
section > text	A human-readable narrative that contains the attested content of the section, used to represent the content of the resource to a human. The narrative need not encode all the structured data, but is required to contain sufficient detail to make it 'clinically safe' for a human to just read the narrative.	11	Narrative	section/text	
section > entry	A reference to the actual resource from which the narrative in the section is derived.	1*	Reference()	section/entry[adv]	observation SHALL conform to the template defined in obser-
				section/entry[adv]/observation	vation (Critical Allergy or Intolerance).

The above template fragment states that each instance of the logical element section is represented as a section with:

- section attributes that are not nullFlavor (e.g. classCode) are allowed as defined in the CDA schema as long as conformance to Base conformance requirements is maintained.
- One templateId with a root="1.2.36.1.2001.1001.102.101.100092". Additional instances of templateId are allowed.
- Exactly one title.
- Exactly one code with a code="48765-2" and a codeSystem="2.16.840.1.113883.6.1" and a displayName.
- At least one entry[adv]/observation that conforms to the template observation (Summary Statement of Allergy or Intolerance) [templateId: 1.2.36.1.2001.1001.102.101.100093]. Additional instances of entry that do not contain an observation are allowed.
- Additional section elements (e.g. author) are allowed as defined in the CDA schema as long as conformance to Base conformance requirements is maintained.

Example 2.8. Interpreting cardinality in a CDA mapping table for logical elements

```
<templateId root="1.2.36.1.2001.1001.102.101.100092"/>
               <code code="48765-2" codeSystem="2.16.840.1.113883.6.1" displayName="Allergies & amp;or adverse reactions"/>
              <title>Critical Allergies and Adverse Reactions</title>
               <text mediaType="text/x-hl7-text+xml">Allergy to Latex (CRITICAL)</text>
              <!--section entry -->
               <entry typeCode="DRIV">
                 <observation classCode="OBS" moodCode="EVN">
                    <templateId root="1.2.36.1.2001.1001.102.101.100093"/>
                 </observation>
              </entry>
            </section>
         </component>
</ClinicalDocument>
```

2.4 Mapping presentation and structure

The CDA templates described in this implementation guide are presented in table format and will be either:

- a mapping of each logical element of the logical model (i.e. profiled FHIR resources published in *Advance Care Records FHIR Implementation Guide [DH2020h]*) to a corresponding CDA attribute or element, or
- a set of CDA attributes or elements with specified infrastructure or control requirements that are not sourced from the logical model but are necessary for supporting the usage scenarios in a CDA implementation.

CDA templates mapping logical elements are roughly grouped by HL7 Reference Information Model (RIM) class within a templates chapter, e.g. 8 Participation CDA templates.

The heading for each child section identifies the CDA schema element that is templated, and may also identify the name of part of the logical model that the template corresponds to, e.g. recordTarget (My Health Record Patient) defines the CDA template of the recordTarget CDA schema element to represent the logical model My Health Record Patient.

2.4.1 Legend - CDA mapping table for logical elements

A CDA mapping table for logical elements aims to take implementers step by step through mapping each element of the logical model to a corresponding CDA attribute or element. The following section describes in more detail the fields used to present the mapping content in this implementation guide.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
CDA conformance level, e.g. CDA Head	er, CDA Body Level 3 Data Elements	Context: The root context that is applied as a prefix to the CDA schema element paths in the mapping rows below			
The logical hierarchical path in the logical model expressed using names of the elements in the logical model. If there is a name in round brackets after the path, this is the label for that element or resource. The text in bold (the last in the path) is the subject for this row in the convention <parent (label)="">> <child (label)="">, e.g. Composition > section (Allergies)</child></parent>	The description of the element in the logical model.	The cardinality of the logical element in the logical model (see Cardinality notation). The root element of each template will typically express an inherited cardinality from the parent element in a parent template by stating: Cardinality comes from linking element A logical cardinality is applied to the mapped CDA schema elements as described in Interpreting cardinality in a CDA mapping table for logical elements: The most strict minimum occurrence between the logical cardinality or the CDA schema defined cardinality is applied. The most strict maximum occurrence applies to CDA schema elements without an [index]. The maximum occurrence of the logical cardinality applies as a pattern 'like this' to CDA schema elements with an [index].	The type of the logical element (hyper-linked to the definition of the [HL7FHIR3] type) in the logical model. This may be expressed as a type that is further constrained by a model in the convention <model name="">, e.g. Patient with Mandatory Identifier.</model>	The CDA schema element(s) in the CDA template that when instantiated are considered to be the CDA representation of that logical element; expressed using an XPath like notation, e.g.: participant[location]/associatedEntity/code The path always starts from the context as defined in the grey header row above each group of mapping rows. The last CDA schema element in the path is presented in bold to aid the reader. Typically a logical model element will map to multiple CDA schema elements. In order to instantiate the logical element in CDA, the minimum cardinality of the mapped CDA schema elements should be understood to be 1 unless an associated constraint is present to indicate a different cardinality (see Interpreting cardinality in a CDA mapping table for logical elements).	Additional information or guidance on implementing the logical element in CDA to support usage scenarios, e.g. When sending to the My Health Record, an IHI is expected. Constraints on the CDA schema elements, identified by use of Conformance verbs, e.g. code/originalText or code/@displayName SHALL be included. Terminology binding, e.g. Address Type HL7 v3 (required).

2.4.2 Legend - CDA mapping table for CDA schema elements

A CDA mapping table for CDA schema elements will define conformance requirements that are not sourced from a logical model and that apply cross all of the supported usage scenarios. The following section describes in more detail the fields used to present the mapping content in this implementation guide.

CDA mapping

CDA schema element	CDA element description	CDA card	CDA constraints and comments	
CDA conformance level, e.g. CDA Header, CDA Body Level 3 Data Elements		Context: The root context that is applied as a prefix to the CDA schema element paths in the mapping rows below		
The CDA schema element(s) in the CDA template using an XPath like notation, e.g.: ClinicalDocument/versionNumber/@value The path always starts from the context as defined in the grey header row above each group of mapping rows. The last CDA schema element in the path is presented in bold to aid the reader.	The description of the CDA schema element definitions, sourced from HL7 Clinical Document Architecture, Release 2 [HL7CDAR2].	The cardinality of the CDA schema element in the template (see Cardinality notation). The root element of a template may express an inherited cardinality from the parent element in a parent template by stating: Cardinality comes from linking element	Additional information or guidance on the use of the CDA schema element to support usage scenarios, e.g. The use of templateld signals the imposition of a set of template-defined constraints. Constraints on the CDA schema elements, identified by use of Conformance verbs, e.g. code/originalText or code/@displayName SHALL be included. Terminology binding, e.g. Address Type HL7 v3 (required).	

3 Conformance

Conformance claims are typically made against the templates in this implementation guide and additional conformance profiles documented elsewhere such as *Common - Clinical Document [DH2019a]*.

3.1 Base conformance requirements

Any document that claims conformance to a ClinicalDocument template defined in this implementation guide or any derived conformance profile **SHALL** meet these base requirements:

- It **SHALL** be a valid HL7 CDA instance. In particular:
 - o It SHALL be valid against the HL7 CDA schema (once extensions have been removed).
 - It **SHALL** conform to the HL7 V3 R1 data type specification.
 - It SHALL conform to the semantics of the RIM and Structural Vocabulary.
- It **SHALL** be valid against the Australian Digital Health Agency CDA schema that accompanies this implementation guide after any additional extensions not in the Australian Digital Health Agency extension namespace have been removed, along with any other CDA content not described by this implementation guide.
- It SHALL conform to the CDA templates it claims conformance to.
- It **SHALL** be valid against the additional conformance requirements that are established in this implementation guide (i.e. any normative use of the word "shall" identified by the term presented in uppercase and bold typeface).
- The narrative SHALL conform to the requirements described in this implementation guide.
- The document SHALL conform to the requirements specified in the CDA Rendering Specification [NEHT2012s].
- · Any additional content included in the CDA document that is not described by this implementation guide:
 - o SHALL NOT qualify or negate content described by this implementation guide
 - SHALL be clinically safe for receivers of the document to ignore the non-narrative additions when interpreting the existing content.

A system that consumes CDA documents that claim conformance to a ClinicalDocument template defined in this implementation guide or any derived conformance profile **SHALL** be able to:

- correctly process conformant instance documents, including correctly understanding all the information in the header and it MAY but is not required to, reject non-conformant documents.
- correctly render the document for end-users when appropriate (see Clinical Document Architecture Release 2) but is not required to process any or all of the structured data entries in the CDA document.

3.2 Conformance profile conformance requirements

Conformance profiles of this implementation guide **MAY** make additional rules that override templates in this implementation guide in regard to:

- Allowing the use of alternative value sets in place of the value sets this is limited to not overriding the rules of the terminology binding strength.
 - For example, a <u>required</u> value set may be overridden by a value set whose values are a subset of those of the <u>required</u> binding.
- Restricting the data type of a CDA schema element or attribute.
- Restricting the allowed values of a CDA schema element or attribute.
- Restricting the cardinality of a CDA schema element or attribute.
- Providing more specific or additional mappings to CDA schema elements or attributes.
- Providing refined usage scenarios, definitions, and implementation guidance.

A conformance profile cannot break the rules established in this implementation guide.

3.3 CDA narrative conformance requirements

CDA requires that each section in its body include a narrative block, containing a clinically complete version of the section's encoded content using custom hypertext markup defined by HL7. The narrative is the human-readable and attestable part of a CDA document, and can stand alone as an accurate representation of the content of the document without any need to consult entries in the body.

It is an *HL7 Clinical Document Architecture [HL7CDAR2]* requirement that all clinical information **SHALL** be marked up in CDA narratives.

It is an *HL7 Clinical Document Architecture [HL7CDAR2]* requirement that the rendered narrative **SHALL** be able to stand alone as a source of authenticated information for consuming parties. Clinically relevant content from the CDA body **SHALL NOT** be omitted from the narrative.

There is no canonical markup for specific CDA components, but some conformance requirements apply:

- The narrative block **SHALL** be encapsulated within the text component of the CDA section.
- The narrative contents SHALL conform to the requirements specified in the CDA Rendering Specification [NEHT2012s].
- The narrative contents SHALL completely and accurately represent the clinical information encoded in the section. Clinical
 content SHALL NOT be omitted from the narrative.
 - o In accordance with the requirement to completely represent section contents, elements of type CodeableConcept SHALL include an original Text or a displayName attribute (or both). Where available, the original Text SHOULD be found in the narrative, otherwise the displayName SHOULD be found in the narrative.
 - In accordance with the requirement to represent section contents in that section, the narrative of the content for a section **SHALL** be contained in that section or, if appropriate, the narrative of an ancestor section.
- The narrative **SHALL** conform to the content requirements of the CDA specification [HL7CDAR2] and the XML schema.

Clinical judgement is required to determine the appropriate presentation for narrative. We may release additional guidance in this regard.



4 Advance Care Planning hierarchy

Advance Care Planning is defined as:

A copy of a statement of an individual's decisions about their future care, should they become incapable of participating in medical treatment decisions. *Advance Care Records FHIR Implementation Guide [DH2020h]*

The table below provides a hierarchical view of the Advance Care Planning model as a tree structure in a hierarchical table; it is not intended to represent how the data contents are represented in a CDA document.

Composition (Advance Care Planning), published as a set of FHIR profiles, can be found in the *Advance Care Records FHIR Implementation Guide [DH2020h]*.

Logical	element		Logical card	Logical type	CDA template
C	Composition (Advance Care Planning)			Advance Care Planning	Composition (Advance Care Planning)
	compositi	on-author-role	01	Reference(PractitionerRole with Practitioner with Mandatory Identifier)	author (PractitionerRole with Practitioner with Mandatory Identifier)
46 XV 89 A	identifier		01	<u>Identifier</u>	
001011001	status		11	code	
001011001	type		11	<u>CodeableConcept</u>	
	subject		11	Reference(Patient with Mandatory Identifier My Health Record Patient)	recordTarget (Patient with Mandatory Identifier)
7"(2)	date		01	<u>dateTime</u>	
	author		11	Reference(RelatedPerson with Mandatory Identifier Patient with Mandatory Identifier Practitioner with Mandatory Identifier)	author (RelatedPerson with Mandatory Identifier) author (Patient with Mandatory Identifier)
T	title		11	string	
	attester (L	egal Attester)	01	<u>BackboneElement</u>	legalAuthenticator
	001011001	mode	11	<u>code</u>	
	7 th	time	11	<u>dateTime</u>	
		party	01	Reference(Patient with Mandatory Identifier Practitioner with Mandatory Identifier)	
		attester-related-party	01	Reference(RelatedPerson with Mandatory Identifier)	
	custodian		11	Reference(Organization with Mandatory Identifier)	custodian (Organization with Mandatory Identifier)
	section (A	dvance Care Information)	11	BackboneElement	section (Advance Care Information)

Logical element				Logical card	Logical type	CDA template
T	title			11	string	
001011001	code			11	CodeableConcept	
	text			11	Narrative	
	entry (Adv Reference		Planning Document	11	Reference (Advance Care Planning Document Reference)	act (Advance Care Planning Document Reference)
		author-rol	e	01	Reference(PractitionerRole with Practitioner with Mandatory Identifier)	author (PractitionerRole with Practitioner with Mandatory Identifier)
	46 X X X X X X X X X X X X X X X X X X X	masterIde	ntifier	01	<u>Identifier</u>	
	46 X X X X X X X X X X X X X X X X X X X	identifier		0*	<u>Identifier</u>	
	001011001	status		11	code	
	001011001	docStatus		01	code	
	001011001	type		11	<u>CodeableConcept</u>	
	8	subject		11	Reference(Patient with Mandatory Identifier My Health Record Patient)	
	7 ***	created		11	<u>dateTime</u>	
	7"29	indexed		11	instant	
	*	author		11	Reference(Practitioner with Mandatory Identifier Patient with Mandatory Identifier RelatedPerson with Mandatory Identifier)	author (PractitionerRole with Practitioner with Mandatory Identifier) author (Patient with Mandatory Identifier)author (RelatedPerson with Mandatory Identifier)
	T	descriptio	n	01	string	
	•	content		11	BackboneElement	
			attachment	11	Attachment	



Note

The column "Logical element" contains the name of that element in the logical model.

The column "Logical card" contains the logical cardinality of that element in the logical model.

The column "Logical type" contains the type of the logical element (hyper-linked to the definition of the [HL7FHIR3] type) in the logical model.

The column "CDA template" contains the title of the corresponding CDA template for that logical element (hyper-linked to CDA mapping table for that template). The convention for the CDA template title is <CDA schema element> (<model name> where the template is not defined in 5 CDA Header templates).

5 CDA Header templates

This chapter contains the CDA Header requirements for this implementation guide; these are infrastructure or control requirements that are not sourced from the Advance Care Planning model.

All the definitions in this chapter are sourced from HL7 Clinical Document Architecture, Release 2 [HL7CDAR2].

5.1 ClinicalDocument

This template is referenced by Composition (Advance Care Planning).

See Legend - CDA mapping table for CDA schema elements for an explanation of mapping table presentation.

CDA mapping

CDA schema element	CDA element description	CDA card	CDA constraints and comments
CDA Header Data Elements		Context: /	
ClinicalDocument	The ClinicalDocument class is the entry point into the CDA R-MIM, and corresponds to the <clinicaldocument> XML element that is the root element of a CDA document.</clinicaldocument>	11	This template SHALL be a closed template. All attributes of the ClinicalDocument element defined by the Australian Digital Health Agency CDA schema SHALL be allowed. All instances of a time value SHALL include hours, minutes and a time zone. The CDA document SHALL be valid against the Australian Digital Health Agency CDA schema after any additional extensions not in the Australian Digital Health Agency extension namespace have been removed.
ClinicalDocument/realmCode	A realmCode signals the imposition of realm-specific constraints. The value identifies the realm in question.	0*	All attributes of the realmCode element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/typeld	A technology-neutral explicit reference to the CDA Release 2 specification.	11	
ClinicalDocument/typeId/@extension="POCD_HD000040"		11	The unique identifier for the CDA Release 2 Hierarchical Description.
ClinicalDocument/typeId/@root="2.16.840.1.113883.1.3"		11	The OID for HL7 Registered models.

CDA schema element	CDA element description	CDA card	CDA constraints and comments
ClinicalDocument/templateId	A templateld signals the imposition of a set of template-defined constraints. The value provides a unique identifier for the templates in question.	1*	All attributes of the templateId element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
			Exactly one template identifier SHALL indicate the constraints defined in this mapping table and have @root="1.2.36.1.2001.1001.102.101.100033".
			Exactly one template identifier SHALL indicate the constraints defined in the CDA Rendering Specification [NEHT2012s] and have @root="1.2.36.1.2001.100.140".
			In addition to the template identifiers above, a template identifier is expected for the clinical document model as per Composition (Advance Care Planning)). Additional template identifiers may be required by other specifications.
			Systems are not required to recognise any other template identifiers than the clinical document model templateld in order to understand the document as a [type] but these identifiers may influence how the document must be handled.
ClinicalDocument/id	Represents the unique instance identifier of a clinical document.	11	All attributes of the id element defined by the Australian Digital Health Agency CDA schema SHALL be allowed with the exception that @nullFlavor SHALL NOT be present.
			id/@root SHALL be present and it SHALL be a UUID or an OID.
ClinicalDocument/ code	The code specifying the particular kind of document (e.g. History and Physical, Discharge Summary, Progress Note).	11	All attributes of the code element defined by the Australian Digital Health Agency CDA schema SHALL be allowed with the exception that @nullFlavor SHALL NOT be present.
ClinicalDocument/title	Represents the title of the document.	01	
ClinicalDocument/effectiveTime	Signifies the document creation time, when the document first came into being. Where the CDA document is a transform from an original document in some other format, the ClinicalDocument.effectiveTime is the time the original document is created.	11	All attributes of the effectiveTime element defined by the Australian Digital Health Agency CDA schema SHALL be allowed with the exception that @nullFlavor SHALL NOT be present.
ClinicalDocument/confidentialityCode/@nullFlavor="NA"	Codes that identify how sensitive a piece of information is and/or that indicate how the information may be made available or disclosed.	11	
ClinicalDocument/languageCode	Specifies the human language of character data (whether they be in contents or attribute	01	<pre><language code=""> - < DIALECT> The < Language Code> SHALL be "en". The < DIALECT> SHOULD</language></pre>
ClinicalDocument/languageCode/@code	values).	11	be "AU".
ClinicalDocument/setId	Represents an identifier that is common across all document revisions.	01	All attributes of the setId element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/versionNumber	An integer value used to version successive replacement documents.	01	
ClinicalDocument/versionNumber/@value		11	
ClinicalDocument/ext:completionCode	The lifecycle status of a document.	11	All attributes of the completionCode element defined by the Australian Digital Health Agency CDA schema SHALL be allowed with the exception that @nullFlavor SHALL NOT be present.
			Australian Healthcare Clinical Document Architecture Document Lifecycle Status (required)
ClinicalDocument/recordTarget	Represents the medical record that this document belongs to.	11	All attributes and elements of the recordTarget element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/author	Represents the humans and/or machines that authored the document.	11	All attributes and elements of the author element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/dataEnterer	Represents the participant who has transformed a dictated note into text.	01	All attributes and elements of the dataEnterer element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.

CDA schema element	CDA element description	CDA card	CDA constraints and comments
ClinicalDocument/informant	Represents an informant (or source of information) who provides relevant information, such as the parent of a comatose patient who describes the patient's behavior prior to the onset of coma. Unless otherwise stated, the patient is implicitly the informant.	0*	All attributes and elements of the informant element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/custodian	Represents the organization from which the document originates and that is in charge of maintaining the document. The custodian is the steward that is entrusted with the care of the document. Every CDA document has exactly one custodian.	11	All attributes and elements of the custodian element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/informationRecipient	Represents a recipient who should receive a copy of the document.	0*	All attributes and elements of the informationRecipient element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/legalAuthenticator	Represents a participant who has legally authenticated the document.	01	All attributes and elements of the legalAuthenticator element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/authenticator	Represents a participant who has attested to the accuracy of the document, but who does not have privileges to legally authenticate the document. An example would be a resident physician who sees a patient and dictates a note, then later signs it.	0*	All attributes and elements of the authenticator element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/participant	Represents a participant not explicitly mentioned by other classes that was somehow involved.	0*	All attributes and elements of the participant element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/inFulfillmentOf	Relates the current document to an order this document fulfills (in whole or in part).	0*	All attributes and elements of the inFulfillmentOf element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/documentationOf	Relates the current document to the related event that this document is documentation of.	0*	All attributes and elements of the documentationOf element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/relatedDocument	Relates the current document to a parent document.	0*	All attributes and elements of the relatedDocument element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/authorization	Relates the current document to consents associated with this document. The consent authorizes or certifies acts specified in the current document.	0*	All attributes and elements of the authorization element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/componentOf	Relates the current document to the encounter. The current document is a documentation of events that occurred during the encounter.	01	All attributes and elements of the componentOf element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.
ClinicalDocument/component	Relates the associated document body as a component of the document.	11	All attributes and elements of the component element defined by the Australian Digital Health Agency CDA schema SHALL be allowed.

5.2 legalAuthenticator

This template is referenced by Composition (Advance Care Planning).

See Legend - CDA mapping table for CDA schema elements for an explanation of mapping table presentation.

CDA mapping

CDA schema element	CDA element description	CDA card	CDA constraints and comments	
CDA Header Data Elements		Context: /ClinicalDocument/		
legalAuthenticator	Represents a participant who has legally authenticated the document.	Cardinality comes from linking element		
legalAuthenticator/templateId	The use of templateId signals the imposition of a set of template-defined con-	11		
legalAuthenticator/templateId/@root="1.2.36.1.2001.1001.102.101.100012"	straints.	11		
legalAuthenticator/time/@value	Indicates the time of authentication.	11		
legalAuthenticator/signatureCode/@code="S"	Indicates that the signature has been affixed and is on file.	11		
legalAuthenticator/assignedEntity	A legalAuthenticator is a person in the role of an assigned entity (AssignedEntity class). An assigned entity is a person assigned to the role by the scoping organization. The entity playing the role is a person (Person class). The entity scoping the role is an organization (Organization class).	11		
legalAuthenticator/assignedEntity/id	A unique identifier for the player entity in this role.	11	id/@root SHALL be present and it SHALL be a UUID or an OID.	
legalAuthenticator/assignedEntity/code	The specific kind of role.	01		
legalAuthenticator/assignedEntity/addr	A postal address for the entity (assignedPerson) while in the role (assignedEntity).	0*		
legalAuthenticator/assignedEntity/ telecom	A telecommunication address for the entity (assignedPerson) while in the role (assignedEntity).	0*		
legal Authenticator/assigned Entity/assigned Person	The entity playing the role (assignedEntity) is a person.	11		
legal Authenticator/assigned Entity/assigned Person/name	A non-unique textual identifier or moniker for the entity (assignedPerson).	0*		
legalAuthenticator/assignedEntity/assignedPerson/ext:asEntityIdentifier	The entity identifier of the person.	0*	The common pattern Entity Identifier SHALL be applied.	
legal Authenticator/assigned Entity/represented Organization	The entity scoping the role (assignedEntity).	01		
legalAuthenticator/assignedEntity/representedOrganization/name	A non-unique textual identifier or moniker for the entity (representedOrganization).	0*		
legalAuthenticator/assignedEntity/representedOrganization/ext:asEntityIdentifier	A unique identifier for the scoping entity (represented organization) in this role (assignedEntity).	0*	The common pattern Entity Identifier SHALL be applied.	

5.3 component (Administrative Observations)

This template is referenced by recordTarget (Patient with Mandatory Identifier), and recordTarget (My Health Record Patient).

See Legend - CDA mapping table for CDA schema elements for an explanation of mapping table presentation.

CDA mapping

CDA schema element	CDA element description	CDA card	CDA constraints and comments	
Conformance level comes from linking elements	Context: /Clinica	Context: /ClinicalDocument/component/structuredBody/		
component[admin_obs]	The models contain a number of elements for which there are no equivalent elements at that point in the hierarchical structure of the model mapped into CDA. These elements are considered to be "Administrative Observations" about the encounter, the patient or some	Cardinality comes from linking element	ClinicalDocument SHALL contain at most one Administrative Observation section. The Administrative Observations section SHALL NOT be populated if there are no entries or text to go in it.	
component[admin_obs]/section	other participant.	11		
component[admin_obs]/section/templateId	Administrative Observations is a CDA section that is created to hold these elements in preference to creating extensions for them.	11	The use of templateld signals the imposition of a set of template-defined constraints.	
component[admin_obs]/section/templateId/@root="1.2.36.1.2001.1001.102.101.100000"	·	11		
component[admin_obs]/section/id	An observation included in this section is an observation relating to the patient (i.e. recordTarget) unless a reference to a different entity	01	id/@root SHALL be present and it SHALL be a UUID or an OID.	
component[admin_obs]/section/ code	is instantiated as part of that observation (e.g. observation/participant/participantRole).	11		
component[admin_obs]/section/code/@code="102.16080"	cipality participaliticoles.	11		
component[admin_obs]/section/code/@codeSystem="1.2.36.1.2001.1001.101"		11	NCTIS Data Components	
component[admin_obs]/section/code/@displayName		01	displayName SHOULD be "Administrative Observations".	
component[admin_obs]/section/title="Administrative Observations"		01		
component[admin_obs]/section/text		01		

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10 March 2020

6 Document CDA templates

This chapter defines each of the document-level usage scenario models, e.g. Composition (Advance Care Planning), as a ClinicalDocument template.

6.1 Composition (Advance Care Planning)

The following are the usage scenarios expected:

- A clinical information system (CIS) sends or receives an Advance Care Plan with the My Health Record system
- A contracted service provider (CSP) sends or receives an Advance Care Plan with the My Health Record system
- A CIS sends or receives an Advance Care Plan with another CIS or CSP
- A CSP sends or receives an Advance Care Plan with a CIS or another CSP
- A registered portal sends or receives an Advance Care Plan
- A registered repository receives an Advance Care Plan

For the usage scenarios for this template it is required that the composition include only the specified top-level sections; additional sections to handle local content not covered by the primary design can be included as one or more child sections within one of the specified top-level sections if desired.

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic-	Logical type	CDA schema element	CDA constraints and comments
		al card			
CDA Header Data Elements				Context: /	
Composition	A copy of a statement of an individual's decisions about their future care, should they become incapable of participating in medical treatment decisions.	0*	Composition	ClinicalDocument	In CDA the maximum occurrences of ClinicalDocument is 1. Although the model indicates that Composition is 0*, in a CDA implementation this is limited to 01.
					In addition to the template defined in this mapping table, ClinicalDocument SHALL conform to the template defined in ClinicalDocument.
				ClinicalDocument/templateId	The use of templateld signals the imposition of a set of
				ClinicalDocument/templateId/@root="1.2.36.1.2001.1001.102.101.100016"	template-defined constraints.
Composition > composition-author-role	A practitioner role that authored this composition. This is not to be confused with who typed in the information.	01	Reference(Practition- erRole with Practi- tioner with Mandat- ory Identifier)	ClinicalDocument/author	author SHALL conform to the template defined in author (PractitionerRole with Practitioner with Mandatory Identifier).
Composition > identifier	Logical identifier for the composition, assigned when created. This identifier stays constant as the composition is changed over time.	01	Identifier	ClinicalDocument/setId	
Composition > status	The workflow/clinical status of this composition. The status is a marker for the clinical standing of the document.	11	<u>code</u>	ClinicalDocument/ext:completionCode	Australian Healthcare Clinical Document Architecture Document Lifecycle Status (required) ¹
Composition > type	Specifies the particular kind of composition (e.g. History	11	CodeableConcept	ClinicalDocument/code	
	and Physical, Discharge Summary, Progress Note). This usually equates to the purpose of making the composition.			ClinicalDocument/code/@code="100.16975"	
				ClinicalDocument/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components
				ClinicalDocument/code/@displayName	displayName SHOULD be "Advance Care Information".
Composition > subject	Who or what the composition is about. The composition can be about a person, (patient or healthcare practitioner), a device (e.g. a machine) or even a group of subjects (such as a document about a herd of livestock, or a set of patients that share a common exposure).	11	Reference(Patient with Mandatory Identifier My Health Record Pa- tient)	ClinicalDocument/recordTarget	When sending to the My Health Record, recordTarget (My Health Record Patient) is expected. recordTarget SHALL conform to one of the templates defined in: recordTarget (Patient with Mandatory Identifier) or recordTarget (My Health Record Patient).
Composition > date	The composition editing time, when the composition was last logically changed by the author.	11	<u>dateTime</u>	ClinicalDocument/author/time	

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Composition > author	Identifies who is responsible for the information in the composition, not necessarily who typed it in.	11	Reference(Patient with Mandatory Identifier Practition- er with Mandatory Identifier Related- Person with Mandat- ory Identifier)	ClinicalDocument/author	In CDA an author (Practitioner) is part of composition-author-role (PractitionerRole); therefore if the author is a practitioner then composition-author-role SHALL be instantiated. author SHALL conform to one of the templates defined in: author (Patient with Mandatory Identifier) or author (RelatedPerson with Mandatory Identifier) or author (PractitionerRole with Practitioner with Mandatory Identifier).
Composition > title	Official human-readable label for the composition.	11	string	ClinicalDocument/title="Advance Care Planning"	
Composition > attester (Legal Attester)	A participant who has attested to the accuracy of the composition/document.	01	BackboneElement	ClinicalDocument/legalAuthenticator	A legal attester SHALL have a party or an attester-related- party but not both. legalAuthenticator SHALL conform to the template defined in legalAuthenticator.
Composition > attester (Legal Attester) > mode	The type of attestation the authenticator offers.	11	<u>code</u>	n/a	Not mapped separately, the logical mode of "legal" is implicit in legalAuthenticator.
Composition > attester (Legal Attester) > time	When the composition was attested by the party.	11	<u>dateTime</u>	ClinicalDocument/legalAuthenticator/time/@value	
Composition > attester (Legal Attester) > party	Who attested the composition in the specified way.	11	Reference(Patient with Mandatory Identifier Practi- tioner with Mandat- ory Identifier)	ClinicalDocument/legalAuthenticator/assignedEntity	
Composition > attester (Legal Attester) > attester-related-party	A related person that attested this composition.	01	Reference(Related- Person with Mandat- ory Identifier)	ClinicalDocument/legalAuthenticator/assignedEntity	
Composition > custodian	Identifies the organization or group who is responsible for ongoing maintenance of and access to the composition/document information.	11	Reference(Organization with Mandatory Identifier)	ClinicalDocument/custodian	custodian SHALL conform to the template defined in custodian (Organization with Mandatory Identifier).
Composition > section (Advance Care	A section that contains a statement of a person's decisions	11	BackboneElement	ClinicalDocument/component/structuredBody/component[aci]	
Information)	about their future care, should they become incapable of participating in medical treatment decisions.			ClinicalDocument/component/structuredBody/component[aci]/section	section SHALL conform to the template defined in section (Advance Care Information).

This value set differs from the value set bound to status in the Agency logical model (see *Advance Care Records FHIR Implementation Guide [DH2020h]*) to support the existing CDA implementation environment. The concept map <u>CompositionStatus</u> (<u>HL7 FHIR</u>) to <u>Australian Healthcare Clinical Document Architecture Document Lifecycle Status</u> provides a mapping between the two value sets.

7 Section CDA templates

This chapter defines the section templates referenced by a ClinicalDocument template for a document-level model in 6 Document CDA templates.

7.1 section (Advance Care Information)

This template is referenced by Composition (Advance Care Planning).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
CDA Body Level 3 Data Elemen	nts			Context: Comes from linking elements	
section	A section that contains a statement of a person's decisions	Cardinal-	BackboneElement	section[aci]	
	about their future care, should they become incapable of participating in medical treatment decisions.	ity comes		section[aci]/templateId	The use of templateId signals the imposition of a set of
,		from linking element		section[aci]/templateId/@root="1.2.36.1.2001.1001.102.101.100009"	template-defined constraints.
section > title	The label for this particular section. This will be part of the rendered content for the document, and is often used to build a table of contents.	11	string	section[aci]/title	
section > code	A code identifying the kind of content contained within the	11	CodeableConcept	section[aci]/code	
	section. This must be consistent with the section title.			section[aci]/code/@code="101.16973"	
				section[aci]/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components
				component/structuredBody/component[aci]/section/code/@displayName	displayName SHOULD be "Advance Care Information Section".
section > text	A human-readable narrative that contains the attested content of the section, used to represent the content of the resource to a human. The narrative need not encode all the structured data, but is required to contain sufficient detail to make it 'clinically safe' for a human to just read the narrative.	11	<u>narrative</u>	section[aci]/text	

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
section > entry	A reference to the actual resource from which the narrative in the section is derived.		Reference(DocumentReference as Advance Care Planning Document Reference)	section[aci]/entry[doc_ref_acp] section[aci]/entry[doc_ref_acp]/act	act SHALL conform to the template defined in act (Advance Care Planning Document Reference).

8 Participation CDA templates

This chapter defines the participation templates referenced other templates such as those in 7 Section CDA templates and 6 Document CDA templates.

8.1 recordTarget (My Health Record Patient)

This template is referenced by Composition (Advance Care Planning).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
CDA Header Data Elements				Context: /ClinicalDocument/	
Patient	Demographics and other administrative information about	Cardinal-	Patient	recordTarget	recordTarget/patientRole/telecom SHALL NOT be present.
	an individual receiving care or other health-related services.	comes			recordTarget/patientRole/addr SHALL NOT be present.
		from linking		recordTarget/templateId	The use of templateld signals the imposition of a set of
		element		recordTarget/templateId/@root="1.2.36.1.2001.1001.102.101.100091"	template-defined constraints.
				recordTarget/patientRole	
				recordTarget/patientRole/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
				recordTarget/patientRole/patient	
Patient > birthPlace	The registered place of birth of the patient. A sytem may	01	<u>Address</u>	recordTarget/patientRole/patient/birthplace	
	use the address.text if they don't store the birthPlace address in discrete elements.			recordTarget/patientRole/patient/birthplace/place	
				recordTarget/patientRole/patient/birthplace/place/addr	Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Patient > indigenous-status	National Health Data Dictionary (NHDD) based indigenous status for a patient.	11	Coding	recordTarget/patientRole/patient/ethnicGroupCode	Australian Indigenous Status (required)

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
CDA Header Data Elements				Context: /ClinicalDocument/component/structuredBody/component[admin_obs]/se	ection/
Patient > closing-the-gap-registration	Indication for eligibility for the Closing the Gap program.	01	boolean	entry[close_gap]	The containing component[admin_obs]/section SHALL conform to the template defined in component (Administrative Observations).
				entry[close_gap]/ observation	
				entry[close_gap]/observation/@classCode="OBS"	
				entry[close_gap]/observation/@moodCode="EVN"	
				entry[close_gap]/observation/ code	
				entry[close_gap]/observation/code/@code="103.32011"	
				entry[close_gap]/observation/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components
				entry[close_gap]/observation/code/@displayName	displayName SHOULD be "Closing the Gap Copayment Eligibility Indicator".
				entry[close_gap]/observation/ value	closing-the-gap-registration is "true" if eligible for Closing the Gap co-payment.
					value/@xsi:type SHALL be "BL".
Patient > patient-mothersMaidenName	Mother's maiden (unmarried) name, commonly collected to help verify patient identity.	01	string	entry[mothers_name]	The containing component[admin_obs]/section SHALL conform to the template defined in component (Administrative Observations).
				entry[mothers_name]/observation	
				entry[mothers_name]/observation/@classCode="OBS"	
				entry[mothers_name]/observation/@moodCode="EVN"	
				entry[mothers_name]/observation/ code	
				entry[mothers_name]/observation/code/@code="103.10245"	
				entry[mothers_name]/observation/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components
				entry[mothers_name]/observation/code/@displayName	displayName SHOULD be "Mother's Original Family Name".
				entry[mothers_name]/observation/value	value/@xsi:type SHALL be "ST".
CDA Header Data Elements				Context: /ClinicalDocument/	
Patient > identifier	An identifier for this patient.	1*	<u>Identifier</u>	recordTarget/patientRole/patient/ext:asEntityIdentifier	The logical cardinality of identifier is 1*. In this template the minimum cardinality is satisfied by supplying a National Individual Healthcare Identifier (ext:asEntityIdentifier[ihi]).
					The common pattern Entity Identifier SHALL be applied.
					Recommended mappings for this logical type to CDA (R2) are available: Identifier.

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Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Patient > identifier (National Individual Healthcare Identifier (IHI))	National Healthcare Identifier (IHI) for the patient.	11	Identifier	recordTarget/patientRole/patient/ext:asEntityIdentifier[ihi] recordTarget/patientRole/patient/ext:asEntityIdentifier[ihi]/@classCode="IDENT" recordTarget/patientRole/patient/ext:asEntityIdentifier[ihi]/ext:id recordTarget/patientRole/patient/ext:asEntityIdentifier[ihi]/ext:id/@root recordTarget/patientRole/patient/ext:asEntityIdentifier[ihi]/ext:id/@assigningAuthorityName="IHI"	In CDA, an Individual Healthcare Identifier (IHI) is sent as the last arc of an OID. For example an IHI of 8003608833357361 would be sent as 1.2.36.1.2001.1003.0.8003608833357361. If present, ext:asEntityIdentifier[ihi]/ext:assigningGeographicArea/ext:name SHALL be "National Identifier". ext:id/@extension SHALL NOT be present. root SHALL be an OID. root SHALL have the OID arcs "1.2.36.1.2001.1003.0" preceding the IHI value. The IHI value (last arc of the root OID) prefix SHALL be "800360". The IHI value (last arc of the root OID) SHALL pass the Luhn algorithm check.
Patient > active	Whether this patient record is in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
Patient > name	A name associated with the individual.	1*	Base HumanName	recordTarget/patientRole/patient/ name	At least one name SHALL contain a family name (name/family). The model Base HumanName is not applied to name. Recommended mappings for this logical type to CDA (R2) are available: Base HumanName.
Patient > gender	Administrative Gender - the gender that the patient is considered to have for administration and record keeping purposes.	11	code	recordTarget/patientRole/patient/administrativeGenderCode	AdministrativeGender (required) ¹
Patient > birthDate	The date of birth for the individual.	11	date	recordTarget/patientRole/patient/ birthTime	

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments	
CDA Header Data Elements				Context: /ClinicalDocument/component/structuredBody/component[admin_obs]/s	ection/	
Patient > birthDate > date-accur- acy-indicator	General date accuracy indicator coding.	01	Coding	entry[dob_acc]	The containing component[admin_obs]/section SHALL conform to the template defined in component (Administrative Observations).	
				entry[dob_acc]/ observation		
				entry[dob_acc]/observation/@classCode="OBS"		
				entry[dob_acc]/observation/@moodCode="EVN"		
				entry[dob_acc]/observation/ code		
				entry[dob_acc]/observation/code/@code="102.16234"		
				entry[dob_acc]/observation/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components	
				entry[dob_acc]/observation/code/@displayName	displayName SHOULD be "Date of Birth Accuracy Indicator".	
				entry[dob_acc]/observation/value	value/@xsi:type SHALL be "CD".	
					Date Accuracy Indicator (required)	
CDA Header Data Elements				Context: /ClinicalDocument/		
Patient > birthDate > patient- birthTime	The time of day that the Patient was born. This includes the date to ensure that the timezone information can be communicated effectively.	01	dateTime	n/a	Not mapped separately, encompassed in patientRole/patient/birthTime.	
Patient > deceased[x]	Indicates if the individual is deceased or not. Deceased date	01	boolean dateTime	recordTarget/patientRole/patient/ext:deceasedInd	Only one of ext:deceasedInd or ext:deceasedTime SHOULD	
	accuracy indicator is optional.			recordTarget/patientRole/patient/ext:deceasedTime	be instantiated.	
CDA Header Data Elements				Context: /ClinicalDocument/component/structuredBody/component[admin_obs]/section/		
Patient > deceased[x] > date-ac- curacy-indicator	General date accuracy indicator coding.	01	Coding	entry[dod_acc]	The containing component[admin_obs]/section SHALL conform to the template defined in component (Administrative Observations).	
				entry[dod_acc]/observation		
				entry[dod_acc]/observation/@classCode="OBS"		
				entry[dod_acc]/observation/@moodCode="EVN"		
				entry[dod_acc]/observation/ code		
				entry[dod_acc]/observation/code/@code="102.16252"		
				entry[dod_acc]/observation/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components	
				entry[dod_acc]/observation/code/@displayName	displayName SHOULD be "Date of Death Accuracy Indicator".	
				entry[dod_acc]/observation/value	value/@xsi:type SHALL be "CD".	
					Date Accuracy Indicator (required)	

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Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
CDA Header Data Elements				Context: /ClinicalDocument/	
Patient > maritalStatus	This field contains a patient's most recent marital (civil) status.	01	CodeableConcept	recordTarget/patientRole/patient/maritalStatusCode	maritalStatusCode/originalText or maritalStatusCode/@dis- playName SHALL be included. Marital Status Codes (extensible)
Patient > multipleBirth[x]	Indicates whether the patient is part of a multiple (bool) or	01	boolean integer	recordTarget/patientRole/patient/ ext:multipleBirthInd	Only one of ext:multipleBirthInd or ext:multiple-
	indicates the actual birth order (integer).			recordTarget/patientRole/patient/ext:multipleBirthOrderNumber	BirthOrderNumber SHOULD be instantiated.
Patient > contact	A contact party (e.g. guardian, partner, friend) for the patient.	0*	<u>BackboneElement</u>	participant[pat_contact]	In CDA, a patient's contact is represented by a participant. participant SHALL conform to the template defined in participant (Patient contact).
Patient > communication	Languages which may be used to communicate with the patient about his or her health.	0*	BackboneElement	recordTarget/patientRole/patient/languageCommunication	
Patient > communication > language	The ISO-639-1 alpha 2 code in lower case for the language, optionally followed by a hyphen and the ISO-3166-1 alpha 2 code for the region in upper case; e.g. 'en' for English, or 'en-US' for American English versus 'en-EN' for England English.	11	CodeableConcept	recordTarget/patientRole/patient/languageCommunication/languageCode	This CDA schema element is of type CodedSimpleValue (CS). Common Languages in Australia (extensible)
Patient > communication > pre- ferred	Indicates whether or not the patient prefers this language (over other languages he masters up a certain level).	01	<u>boolean</u>	recordTarget/patientRole/patient/languageCommunication/preferenceInd	
Patient > generalPractitioner	Patient's nominated care provider.	0*	Reference(Base Organization Base Practitioner)	participant[gen_prac]	participant SHALL conform to one of the templates defined in: participant (generalPractitioner Base Organization) or participant (generalPractitioner Base Practitioner).
Patient > managingOrganization	Organization that is the custodian of the patient record.	01	Reference(Base Organization)	recordTarget/patientRole/providerOrganization	providerOrganization SHALL conform to the template defined in providerOrganization (Base Organization).

¹This hyperlink resolves to the FHIR Release 4 description due to a technical defect in the FHIR STU3 description of this code system for OID-based systems.

8.2 recordTarget (Patient with Mandatory Identifier)

This template is referenced by Composition (Advance Care Planning).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
CDA Header Data Elements				Context: /ClinicalDocument/	
Patient	Demographics and other administrative information about	Cardinal-	<u>Patient</u>	recordTarget	
	an individual receiving care or other health-related services.	ity comes from link-		recordTarget/templateId	The use of templateld signals the imposition of a set of
		ing ele- ment		recordTarget/templateId/@root="1.2.36.1.2001.1001.102.101.100004"	template-defined constraints.
		lilelit		recordTarget/patientRole	
				recordTarget/patientRole/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
				recordTarget/patientRole/ patient	
Patient > birthPlace	The registered place of birth of the patient. A sytem may	01	Address	recordTarget/patientRole/patient/birthplace	
	use the address.text if they don't store the birthPlace address in discrete elements.			recordTarget/patientRole/patient/birthplace/place	
				recordTarget/patientRole/patient/birthplace/place/addr	Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Patient > indigenous-status	National Health Data Dictionary (NHDD) based indigenous status for a patient.	01	Coding	recordTarget/patientRole/patient/ ethnicGroupCode	Australian Indigenous Status (required)

Logical element	Logical element description	Logical	Logical type	CDA schema element	CDA constraints and comments
		card			
CDA Header Data Elements				Context: /ClinicalDocument/component/structuredBody/component[admin_obs]/se	
Patient > closing-the-gap-regis- tration	Indication for eligibility for the Closing the Gap program.	01	boolean	entry[close_gap]	The containing component[admin_obs]/section SHALL conform to the template defined in component (Administrative Observations).
				entry[close_gap]/ observation	
				entry[close_gap]/observation/@classCode="OBS"	
				entry[close_gap]/observation/@moodCode="EVN"	
				entry[close_gap]/observation/code	
				entry[close_gap]/observation/code/@code="103.32011"	
				entry[close_gap]/observation/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components
				entry[close_gap]/observation/code/@displayName	displayName SHOULD be "Closing the Gap Copayment Eligibility Indicator".
				entry[close_gap]/observation/value	closing-the-gap-registration is "true" if eligible for Closing the Gap co-payment.
					value/@xsi:type SHALL be "BL".
Patient > patient-mothersMaid- enName	Mother's maiden (unmarried) name, commonly collected to help verify patient identity.	01	string	entry[mothers_name]	The containing component[admin_obs]/section SHALL conform to the template defined in component (Administrative Observations).
				entry[mothers_name]/observation	
				entry[mothers_name]/observation/@classCode="OBS"	
				entry[mothers_name]/observation/@moodCode="EVN"	
				entry[mothers_name]/observation/code	
				entry[mothers_name]/observation/code/@code="103.10245"	
				entry[mothers_name]/observation/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components
				entry[mothers_name]/observation/code/@displayName	displayName SHOULD be "Mother's Original Family Name".
				entry[mothers_name]/observation/value	value/@xsi:type SHALL be "ST".
CDA Header Data Elements				Context: /ClinicalDocument/	
Patient > identifier	An identifier for this patient.	1*	Identifier	recordTarget/patientRole/patient/ext:asEntityIdentifier	The common pattern Entity Identifier SHALL be applied.
					Recommended mappings for this logical type to CDA (R2) are available: Identifier.
Patient > active	Whether this patient record is in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
Patient > name	A name associated with the individual.	0*	Base HumanName	recordTarget/patientRole/patient/ name	The model Base HumanName is not applied to name.
					Recommended mappings for this logical type to CDA (R2) are available: Base HumanName.
				•	

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Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Patient > telecom	A contact detail (e.g. a telephone number or an email address) by which the individual may be contacted.	0*	ContactPoint	recordTarget/patientRole/ telecom	Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Patient > gender	Administrative Gender - the gender that the patient is considered to have for administration and record keeping purposes.	01	code	recordTarget/patientRole/patient/administrativeGenderCode	In the Australian Digital Health Agency CDA schema the minimum occurrence of administrativeGenderCode is 1.
					Although administrativeGenderCode is required, a sending system may send a patient without gender by instantiating administrativeGenderCode/@nullFlavor="NI". No other nullFlavor value SHALL be allowed.
					AdministrativeGender (required) ¹
Patient > birthDate	The date of birth for the individual.	01	date	recordTarget/patientRole/patient/birthTime	
CDA Header Data Elements				Context: /ClinicalDocument/component/structuredBody/component[admin_obs]/se	ction/
Patient > birthDate > date-accur- acy-indicator	General date accuracy indicator coding.	01	Coding	entry[dob_acc]	The containing component[admin_obs]/section SHALL conform to the template defined in component (Administrative Observations).
				entry[dob_acc]/observation	
				entry[dob_acc]/observation/@classCode="OBS"	
				entry[dob_acc]/observation/@moodCode="EVN"	
				entry[dob_acc]/observation/code	
				entry[dob_acc]/observation/code/@code="102.16234"	
				entry[dob_acc]/observation/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components
				entry[dob_acc]/observation/code/@displayName	displayName SHOULD be "Date of Birth Accuracy Indicator".
				entry[dob_acc]/observation/value	value/@xsi:type SHALL be "CD".
					Date Accuracy Indicator (required)
CDA Header Data Elements				Context: /ClinicalDocument/	
Patient > birthDate > patient- birthTime	The time of day that the Patient was born. This includes the date to ensure that the timezone information can be communicated effectively.	01	dateTime	n/a	Not mapped separately, encompassed in patientRole/patient/birthTime.
Patient > deceased[x]	Indicates if the individual is deceased or not. Deceased date	01	boolean dateTime	recordTarget/patientRole/patient/ext:deceasedInd	Only one of ext:deceasedInd or ext:deceasedTime SHOULD
	accuracy indicator is optional.			recordTarget/patientRole/patient/ext:deceasedTime	be instantiated.

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments	
CDA Header Data Elements				Context: /ClinicalDocument/component/structuredBody/component[admin_obs]/se	ection/	
Patient > deceased[x] > date-ac- curacy-indicator	General date accuracy indicator coding.	01	Coding	entry[dod_acc]	The containing component[admin_obs]/section SHALL conform to the template defined in component (Administrative Observations).	
				entry[dod_acc]/observation		
				entry[dod_acc]/observation/@classCode="OBS"		
				entry[dod_acc]/observation/@moodCode="EVN"		
				entry[dod_acc]/observation/ code		
				entry[dod_acc]/observation/code/@code="102.16252"		
				entry[dod_acc]/observation/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components	
			entry[dod_acc]/observation/code/@displayName	displayName SHOULD be "Date of Death Accuracy Indicator".		
				entry[dod_acc]/observation/value	value/@xsi:type SHALL be "CD".	
					Date Accuracy Indicator (required)	
CDA Header Data Elements				Context: /ClinicalDocument/		
Patient > address	Addresses for the individual.	0*	Address	recordTarget/patientRole/addr	Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.	
Patient > maritalStatus	This field contains a patient's most recent marital (civil) status.	01	CodeableConcept	recordTarget/patientRole/patient/maritalStatusCode	maritalStatusCode/originalText or maritalStatusCode/@dis- playName SHALL be included.	
					Marital Status Codes (extensible)	
Patient > multipleBirth[x]	Indicates whether the patient is part of a multiple (bool) or	01	boolean integer	recordTarget/patientRole/patient/ext:multipleBirthInd	Only one of ext:multipleBirthInd or ext:multiple-	
	indicates the actual birth order (integer).			recordTarget/patientRole/patient/ext:multipleBirthOrderNumber	BirthOrderNumber SHOULD be instantiated.	
Patient > contact	A contact party (e.g. guardian, partner, friend) for the pa-	0*	<u>BackboneElement</u>	participant[pat_contact]	In CDA, a patient's contact is represented by a participant.	
	tient.				participant SHALL conform to the template defined in participant (Patient contact).	
Patient > communication	Languages which may be used to communicate with the patient about his or her health.	0*	<u>BackboneElement</u>	recordTarget/patientRole/patient/languageCommunication		
Patient > communication > lan- guage	The ISO-639-1 alpha 2 code in lower case for the language, optionally followed by a hyphen and the ISO-3166-1 alpha 2 code for the region in upper case; e.g. 'en' for English, or 'en-US' for American English versus 'en-EN' for England English.	11	CodeableConcept	recordTarget/patientRole/patient/languageCommunication/languageCode	This CDA schema element is of type CodedSimpleValue (CS). Common Languages in Australia (extensible)	
Patient > communication > pre- ferred	Indicates whether or not the patient prefers this language (over other languages he masters up a certain level).	01	boolean	recordTarget/patientRole/patient/languageCommunication/preferenceInd		

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Patient > generalPractitioner	Patient's nominated care provider.	0*	Reference(Base Organization Base Practitioner)	participant[gen_prac]	participant SHALL conform to one of the templates defined in: participant (generalPractitioner Base Organization) or participant (generalPractitioner Base Practitioner).
Patient > managingOrganization	Organization that is the custodian of the patient record.	01	Reference(Base Organization)	recordTarget/patientRole/providerOrganization	providerOrganization SHALL conform to the template defined in providerOrganization (Base Organization).

¹This hyperlink resolves to the FHIR Release 4 description due to a technical defect in the FHIR STU3 description of this code system for OID-based systems.

8.3 participant (Patient contact)

This template is referenced by recordTarget (Patient with Mandatory Identifier), and recordTarget (My Health Record Patient).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
CDA Header Data Elements				Context: /ClinicalDocument/	
Patient > contact	A contact party (e.g. guardian, partner, friend) for the pa-	Cardinal-	BackboneElement	participant[pat_contact]	The patient's contact SHALL have at least:
	tient.	ity comes from link- ing ele-		participant[pat_contact]/@typeCode="IND"	name (participant[pat_contact]/associatedEntity/associ- atedPerson/name), or
		ment			telecom (participant[pat_contact]/associatedEntity/tele- com), or
					address (participant[pat_contact]/associatedEntity/ad- dr), or
					organization (participant[pat_contact]/associatedEntity/scopingOrganization)
				participant[pat_contact]/templateId	The use of templateld signals the imposition of a set of
				participant[pat_contact]/templateId/@root="1.2.36.1.2001.1001.102.101.100056"	template-defined constraints.
				participant[pat_contact]/associatedEntity	
				participant[pat_contact]/associatedEntity/@classCode="CON"	
				participant[pat_contact]/associatedEntity/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
Patient > contact > relationship	The nature of the relationship between the patient and the contact person.	0*	CodeableConcept	participant[pat_contact]/associatedEntity/associatedPerson/ext:personalRelationship	The common pattern Personal Relationship SHALL be applied.
				participant[pat_contact]/associatedEntity/associatedPerson/ ext:personalRelationship/ext:code	ext:code/originalText or ext:code/@displayName SHALL be included.
					Contact Relationship Type (extensible)
Patient > contact > name	A name associated with the contact person.	01	Base HumanName	participant[pat_contact]/associatedEntity/associatedPerson/name	The model Base HumanName is not applied to name.
					Recommended mappings for this logical type to CDA (R2) are available: Base HumanName.

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Patient > contact > telecom	A contact detail for the person, e.g. a telephone number or an email address.	0*	ContactPoint	participant[pat_contact]/associatedEntity/telecom	Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Patient > contact > address	Address for the contact person.	01	<u>Address</u>	participant[pat_contact]/associatedEntity/addr	Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Patient > contact > gender	Administrative Gender - the gender that the contact person is considered to have for administration and record keeping purposes.	01	code	participant[pat_contact]/associatedEntity/ associatedPerson/ext:administrativeGenderCode	AdministrativeGender (required) ¹
Patient > contact > organization	Organization on behalf of which the contact is acting or for which the contact is working.	01	Reference(Base Organization)	participant[pat_contact]/associatedEntity/scopingOrganization	scopingOrganization SHALL conform to the template defined in scopingOrganization (Base Organization).
Patient > contact > period	The period during which this contact person or organization is valid to be contacted relating to this patient.	01	Period	n/a	This logical element has no mapping to CDA.

¹This hyperlink resolves to the FHIR Release 4 description due to a technical defect in the FHIR STU3 description of this code system for OID-based systems.

8.4 participant (Organization contact)

This template is referenced by participant (generalPractitioner Base Organization), custodian (Organization with Mandatory Identifier), providerOrganization (Base Organization), represented dorganization (Base Organization), scopingOrganization (Base Organization), and wholeOrganization (Base Organization).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments				
CDA Header Data Elements				Context: /ClinicalDocument/	Context: /ClinicalDocument/				
Organization > contact	Contact for the organization for a cer-	Cardinality	Organization	participant[org_contact]					
	tain purpose.	from link-		participant[org_contact]/@typeCode="IND"					
		ing ele- ment		participant[org_contact]/templateId	The use of templateId signals the imposition of a set of template-				
		ment		participant[org_contact]/templateId/@root="1.2.36.1.2001.1001.102.101.100035"	defined constraints.				
				participant[org_contact]/associatedEntity					
				participant[org_contact]/associatedEntity/@classCode="CON"					
				participant[org_contact]/associatedEntity/scopingOrganization					
				participant[org_contact]/associatedEntity/scopingOrganization/id	Organization > contact is represented in CDA by a participant that is scoped by the Organization for which they are a contact.				
					This id SHALL hold the same value as the organization this is a contact for (the value in this id element SHALL be present in a separate participation).				
					id/@root SHALL be present and it SHALL be a UUID or an OID.				
Organization > contact > purpose	Indicates a purpose for which the con-	01	<u>CodeableConcept</u>	participant[org_contact]/associatedEntity/ code	code/originalText or code/@displayName SHALL be included.				
	tact can be reached.				Contact entity type (extensible) ¹				
Organization > contact > name	A name associated with the contact.	01	Base HumanName	participant[org_contact]/associatedEntity/associatedPerson					
				participant[org_contact]/associatedEntity/associatedPerson/name	The model Base HumanName is not applied to name.				
					Recommended mappings for this logical type to CDA (R2) are available: Base HumanName.				
Organization > contact > telecom	A contact detail (e.g. a telephone number or an email address) by which the party may be contacted.	0*	ContactPoint	participant[org_contact]/associatedEntity/telecom	Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.				

Ī	· ·	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
(Organization > contact > address	Visiting or postal addresses for the contact.	01	<u>Address</u>		Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.

This value set differs from the value set bound to contact purpose in the Agency logical model (see Advance Care Records FHIR Implementation Guide [DH2020h]) due to pre-adoption of FHIR Release 4 terminology.

8.5 participant (generalPractitioner Base Organization)

This template is referenced by recordTarget (Patient with Mandatory Identifier), and recordTarget (My Health Record Patient).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments	
CDA Header Data Elements				Context: /ClinicalDocument/		
Organization	A formally or informally recognized grouping of people or organizations formed for the purpose of achieving some form of collective action. Includes companies, institutions, corporations, departments, community groups, healthcare practice groups, etc.		Organization	participant[gen_prac]	Organization SHALL have at least:	
				participant[gen_prac]/@typeCode="PART"	identifier (participant[gen_prac]/associatedEntity/scop- ingOrganization/ext:asEntityIdentifier), or name (participant[gen_prac]/associatedEntity/scopin- gOrganization/name)	
					gorganization/manic/	
				participant[gen_prac]/ templateId	The use of templateId signals the imposition of a set of	
				participant[gen_prac]/templateId/@root="1.2.36.1.2001.1001.102.101.100036"	template-defined constraints.	
				participant[gen_prac]/functionCode/@code="PCP"		
				participant[gen_prac]/associatedEntity		
				participant[gen_prac]/associatedEntity/@classCode="PROV"		
				participant[gen_prac]/associatedEntity/id	id/@root SHALL be present and it SHALL be a UUID or an OID.	
Organization > identifier	Identifier for the organization that is used to identify the organization across multiple disparate systems.	0*	Identifier	participant[gen_prac]/associatedEntity/scopingOrganization/ext:asEntityIdentifier	The common pattern Entity Identifier SHALL be applied.	
					Recommended mappings for this logical type to CDA (R2) are available: Identifier.	
Organization > active	Whether the organization's record is still in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.	
Organization > type	The kind(s) of organization that this is.	0*	CodeableConcept	participant[gen_prac]/associatedEntity/ code	In CDA the maximum occurrences of associatedEntity/code is 1. Although the model indicates that code is 0*, in a CDA implementation this is limited to 01.	
					code/originalText or code/@displayName SHALL be included.	
					OrganizationType (example)	

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Organization > name	A name associated with the organization.	01	string	participant[gen_prac]/associatedEntity/scopingOrganization/name[org_name]	In CDA name and alias are represented by scopingOrganization/name.
Organization > alias	A list of alternate names that the organization is known as, or was known as in the past.	0*	string	participant[gen_prac]/associatedEntity/scopingOrganization/name[alias]	In CDA name and alias are represented by scopingOrganization/name.
Organization > telecom	A contact detail for the organization.	0*	ContactPoint	participant[gen_prac]/associatedEntity/ telecom	telecom/@use Organization Telecom Use HL7 V3 (required) ¹ . Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Organization > address	An address for the organization.	0*	Address	participant[gen_prac]/associatedEntity/ addr	addr/@use Organization Address Use HL7 V3 (required) ² . Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Organization > partOf	The organization of which this organization forms a part.	01	Reference(Base Organization)	participant[gen_prac]/associatedEntity/scopingOrganization/asOrganizationPartOf	wholeOrganization SHALL conform to the template defined in wholeOrganization (Base Organization).
				participant[gen_prac]/associatedEntity/scopingOrganization/asOrganizationPartOf/wholeOrganization	
Organization > contact	Contact for the organization for a certain purpose.	0*	BackboneElement	participant[org_contact]	participant[org_contact] SHALL conform to the template defined in participant (Organization contact).

This value set differs from the value set bound to use in ContactPoint due to constraints on @use in the HL7 CDA Schema. The concept map v3 map for ContactPointUse provides a mapping between the two value sets.

²This value set differs from the value set bound to use in Address due to constraints on @use in the HL7 CDA schema. The concept map v3 map for AddressUse provides a mapping between the two value sets.

8.6 participant (generalPractitioner Base Practitioner)

This template is referenced by recordTarget (Patient with Mandatory Identifier), and recordTarget (My Health Record Patient).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments	
CDA Header Data Elements				Context: /ClinicalDocument/		
Practitioner	A person who is directly or indirectly involved in the provisioning of healthcare.	Cardinal- ity comes from link- ing ele- ment	Practitioner	participant[gen_prac]	Practitioner SHALL have at least:	
				participant[gen_prac]/@typeCode="PART"	identifier (participant[gen_prac]/associatedEntity/associated- Person/ext:asEntityIdentifier), or	
					name (participant[gen_prac]/associatedEntity/associatedPer- son/name)	
				participant[gen_prac]/templateId	The use of templateId signals the imposition of a set of template-	
				participant[gen_prac]/templateId/@root="1.2.36.1.2001.1001.102.101.100037"	defined constraints.	
				participant[gen_prac]/functionCode/@code="PCP"		
				participant[gen_prac]/associatedEntity		
				participant[gen_prac]/associatedEntity/@classCode="PROV"		
				participant[gen_prac]/associatedEntity/id	id/@root SHALL be present and it SHALL be a UUID or an OID.	
				participant[gen_prac]/associatedEntity/code	The cardinality of code SHALL be interpreted as 01.	
					Australian and New Zealand Standard Classification of Occupations (preferred)	
Practitioner > identifier	An identifier that applies to this person in this role.	0*	Identifier	participant[gen_prac]/associatedEntity/associatedPerson/ext:asEntityIdentifier	The common pattern Entity Identifier SHALL be applied.	
					Recommended mappings for this logical type to CDA (R2) are available: Identifier.	
Practitioner > active	Whether this practitioner's record is in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.	
Practitioner > name	The name(s) associated with the practition-	0*	Base HumanName	participant[gen_prac]/associatedEntity/associatedPerson/name	The model Base HumanName is not applied to name.	
	er.				Recommended mappings for this logical type to CDA (R2) are available: Base HumanName.	

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Practitioner > telecom	A contact detail for the practitioner, e.g. a telephone number or an email address.	0*	ContactPoint	participant[gen_prac]/associatedEntity/telecom	Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Practitioner > address	Address(es) of the practitioner that are not role specific (typically home address). Work addresses are not typically entered in this property as they are usually role dependent.	0*	Address	participant[gen_prac]/associatedEntity/ addr	Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Practitioner > gender	Administrative Gender - the gender that the person is considered to have for administration and record keeping purposes.	01	code	n/a	This logical element has no mapping to CDA.
Practitioner > birthDate	The date of birth for the practitioner.	01	<u>date</u>	n/a	This logical element has no mapping to CDA.
Practitioner > qualification	Qualifications obtained by training and certification.	0*	BackboneElement	See: instantiation choices	It is possible that the qualification may be able to be captured as a complex structure or as a text list. instantiation choices: If the qualification or list of qualifications is the result of capturing a text field then qualification is expected to be instantiated as ext:asQualifications/@classCode="QUAL". The common pattern Qualification SHALL be applied. If more information can be captured than a narrative list then qualification is expected to be instantiated as ClinicalDocument/component/structuredBody/component[admin_obs]/section/ext:coverage2[prac_qual] and SHALL conform to the template defined in ext:coverage2 (Practitioner qualification).
Practitioner > communication	A language the practitioner is able to use in patient communication.	0*	CodeableConcept	participant[gen_prac]/associatedEntity/associatedPerson/ext:languageCommunication	The common pattern Language Communication SHALL be applied.

8.7 author (Patient with Mandatory Identifier)

This template is referenced by act (Advance Care Planning Document Reference).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Conformance level comes from linking	elements			Context: Comes from linking elements	
Patient	Patient Demographics and other administrative information about an individual receiving care or other health-related services.	Cardinality comes from link- ing ele- ment	Patient	author	Patient SHALL have at least: • name (author/assignedAuthor/assignedPerson/name), or • identifier (author/assignedAuthor/assignedPerson/ext:asEntityIdentifier)
				author/templateId	The use of templateld signals the imposition of a set of
				author/templateId/@root="1.2.36.1.2001.1001.102.101.100003"	template-defined constraints.
				author/assignedAuthor	
				author/assignedAuthor/id	author (patient) is represented in CDA by an author with the same id as the patient that is the subject of this document.
					This id SHALL hold the same value as patientRole/id.
				author/assignedAuthor/code	
				author/assignedAuthor/code/@code="ONESELF"	
				author/assignedAuthor/code/@codeSystem="2.16.840.1.113883.5.111"	v3 Code System RoleCode
2 11 11 11 11		0.4		author/assignedAuthor/assignedPerson	
Patient > birthPlace	The registered place of birth of the patient. A sytem may use the address.text if they don't store the birth-Place address in discrete elements.	01	Address	n/a	Not mapped directly for this participant; this is implicit in patientRole/patient/birthPlace/place/addr.
Patient > indigenous-status	National Health Data Dictionary (NHDD) based indigenous status for a patient.	01	Coding	n/a	Not mapped directly for this participant; this is implicit in patientRole/patient/ethnicGroupCode.
Patient > closing-the-gap-registration	Indication for eligibility for the Closing the Gap program.	01	boolean	n/a	Not mapped directly for this participant; this is implicit in entry[close_gap]/observation/value.

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Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Patient > patient-mothersMaiden- Name	Mother's maiden (unmarried) name, commonly collected to help verify patient identity.	01	string	n/a	Not mapped directly for this participant; this is implicit in entry[mothers_name]/observation/value.
Patient > identifier	An identifier for this patient.	1*	<u>Identifier</u>	author/assignedAuthor/assignedPerson/ext:asEntityIdentifier	When sending to the My Health Record, an IHI is expected.
					The common pattern Entity Identifier SHALL be applied.
					Recommended mappings for the complex data type to CDA (R2): Identifier.
Patient > active	Whether this patient record is in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
Patient > name	A name associated with the individual.	0*	Base HumanName	author/assignedAuthor/assignedPerson/ name	The model Base HumanName is not applied to name.
					Recommended mappings for this logical type to CDA (R2) are available: Base HumanName.
Patient > telecom	A contact detail (e.g. a telephone number or an email address) by which the individual may be contacted.	0*	ContactPoint	author/assignedAuthor/telecom	When sending to the My Health Record, telecom is not expected to be sent.
					Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Patient > gender	Administrative Gender - the gender that the patient is considered to have for administration and record keeping purposes.	01	code	author/assigned Author/assigned Person/ext: administrative Gender Code	AdministrativeGender (required) ¹
Patient > birthDate	The date of birth for the individual.	01	date	n/a	Not mapped directly for this participant; this is implicit in patientRole/patient/birthTime.
Patient > deceased[x]	Indicates if the individual is deceased or not. Deceased date accuracy indicator is optional.	01	boolean dateTime	n/a	Not mapped directly for this participant; this is implicit in patientRole/patient/ext:deceasedTime or patientRole/patient/ext:deceasedInd.
Patient > address	Addresses for the individual.	0*	Address	author/assignedAuthor/addr	When sending to the My Health Record, address is not expected to be sent.
					Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Patient > maritalStatus	This field contains a patient's most recent marital (civil) status.	01	CodeableConcept	n/a	Not mapped directly for this participant; this is implicit in patientRole/patient/maritalStatusCode.
Patient > multipleBirth[x]	Indicates whether the patient is part of a multiple (bool) or indicates the actual birth order (integer).	01	boolean integer	n/a	Not mapped directly for this participant; this is implicit in patientRole/patient/ext:multipleBirthInd or patientRole/patient/multipleBirthOrderNumber.
Patient > contact	A contact party (e.g. guardian, partner, friend) for the patient.	0*	BackboneElement	n/a	This logical element has no mapping to CDA.
Patient > communication	Languages which may be used to communicate with the patient about his or her health.	0*	BackboneElement	n/a	Not mapped directly for this participant; this is implicit in patientRole/patient/languageCommunication.
Patient > generalPractitioner	Patient's nominated care provider.	0*	Reference(Base Organ- ization Base Practi- tioner)	n/a	This logical element has no mapping to CDA.

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Patient > managingOrganization	Organization that is the custodian of the patient record.	01	Reference (Base Organization)	n/a	This logical element has no mapping to CDA.

¹This hyperlink resolves to the FHIR Release 4 description due to a technical defect in the FHIR STU3 description of this code system for OID-based systems.

8.8 author (RelatedPerson with Mandatory Identifier)

This template is referenced by act (Advance Care Planning Document Reference).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Conformance level comes from	m linking elements			Context: Comes from linking elements	
RelatedPerson	Information about a person that is involved in the care for a patient, but who is not the target of healthcare, nor has a formal responsibility in the care process.	Cardinal- ity comes from linking ele- ments	RelatedPerson	author	RelatedPerson SHALL have at least: • name (author/assignedAuthor/assignedPerson/name), or • identifier (author/assignedAuthor/assignedPerson/ext:asEntityIdentifier), or • relationship (author/assignedAuthor/assignedPerson/ext:personalRelationship)
				author/templateId	The use of templateld signals the imposition of a set of
				author/templateId/@root="1.2.36.1.2001.1001.102.101.100030"	template-defined constraints.
				author/assignedAuthor	
				author/assignedAuthor/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
				author/assignedAuthor/ code	
				author/assignedAuthor/code/@code="AGNT"	
				author/assignedAuthor/code/@codeSystem="2.16.840.1.113883.5.110"	v3 Code System RoleClass
				author/assignedAuthor/assignedPerson	
RelatedPerson > identifier	Identifier for a person within a particular scope.	1*	<u>Identifier</u>	author/assignedAuthor/assignedPerson/ext:asEntityIdentifier	The common pattern Entity Identifier SHALL be applied. Recommended mappings for this logical type to CDA (R2) are available: Identifier.
RelatedPerson > active	Whether this related person record is in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
RelatedPerson > patient	The patient this person is related to.	11	Reference(Base Patient)	n/a	Not mapped directly for this participant; this is implicit in patientRole.

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
RelatedPerson > relationship	The nature of the relationship between a patient and the related person.	01	CodeableConcept	author/assignedAuthor/assignedPerson/ext:personalRelationship	The common pattern Personal Relationship SHALL be applied.
				author/assignedAuthor/assignedPerson/ext:personalRelationship/ext:code	ext:code/originalText or ext:code/@displayName SHALL be included.
					Related Person Relationship Type (extensible)
RelatedPerson > name	A name associated with the person.	0*	Base HumanName	author/assignedAuthor/assignedPerson/name	The model Base HumanName is not applied to name.
					Recommended mappings for this logical type to CDA (R2) are available: Base HumanName.
RelatedPerson > telecom	A contact detail for the person, e.g. a telephone number or an email address.	0*	ContactPoint	author/assignedAuthor/telecom	Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
RelatedPerson > gender	Administrative Gender - the gender that the person is considered to have for administration and record keeping purposes.	01	<u>code</u>	author/assignedAuthor/assignedPerson/ext:administrativeGenderCode	AdministrativeGender (required) ¹
RelatedPerson > birthDate	The date on which the related person was born.	01	<u>date</u>	author/assignedAuthor/assignedPerson/ext:birthTime	
RelatedPerson > address	Address where the related person can be contacted or visited.	0*	Address	author/assignedAuthor/addr	Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
RelatedPerson > period	The period of time that this relationship is considered to be valid. If there are no dates defined, then the interval is unknown.	01	Period	n/a	Not mapped separately, implicit in ext:personalRelation- ship/ext:effectiveTime.

¹This hyperlink resolves to the FHIR Release 4 description due to a technical defect in the FHIR STU3 description of this code system for OID-based systems.

8.9 author (PractitionerRole with Practitioner with Mandatory Identifier)

This template is referenced by Composition (Advance Care Planning), and act (Advance Care Planning Document Reference).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Conformance level comes from li	nking elements			Context: Comes from linking elements	
PractitionerRole	A specific set of Roles/Locations/specialties/services that a	Cardinality	<u>PractitionerRole</u>	author	
	practitioner may perform at an organization for a period of time.	comes from link-		author/templateId	The use of templateId signals the imposition of a set of template-
		ing ele- ment		author/templateId/@root="1.2.36.1.2001.1001.102.101.100006"	defined constraints.
		ment		author/assignedAuthor	
				author/assignedAuthor/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
PractitionerRole > identifier	Business identifiers for practitioner in a role.	0*	<u>Identifier</u>	author/assignedAuthor/assignedPerson/ext:asEntityIdentifier	In CDA the identifier for both PractitionerRole and Practitioner for an author participation are included in assignedPerson/ext:asEntity-Identifier.
					When sending to the My Health Record, an HPI-I is expected.
					The cardinality of ext:asEntityIdentifier SHALL be interpreted as 1*.
					The common pattern Entity Identifier SHALL be applied.
					Recommended mappings for this logical type to CDA (R2) are available: Identifier.
PractitionerRole > active	Whether this practitioner's record is in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
PractitionerRole > period	The period during which the person is authorized to act as a practitioner in these role(s) for the organization.	01	Period	n/a	This logical element has no mapping to CDA.
PractitionerRole > practitioner	Practitioner that is able to provide the defined services for the organation.	11	Reference(Practition- er with Mandatory Identifier)	author/assignedAuthor/assignedPerson	assignedPerson SHALL conform to the template defined in assigned- Person (Practitioner with Mandatory Identifier).
PractitionerRole > organization	The organization where the Practitioner performs the roles associated.	01	Reference(Base Organization)	author/assignedAuthor/representedOrganization	representedOrganization SHALL conform to the template defined in representedOrganization (Base Organization).

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
PractitionerRole > code	Roles which this practitioner is authorized to perform for the organization.	0*	CodeableConcept	author/assignedAuthor/code	In CDA the maximum occurrences of assignedAuthor/code is 1. Although the model indicates that code is 0*, in a CDA implementation this is limited to 01.
					A code equivalent to the provider's professional role, e.g. 159011008 Community pharmacist is expected.
					code/originalText or code/@displayName SHALL be included.
					Australian and New Zealand Standard Classification of Occupations (preferred) or Practitioner Role (preferred) ¹
PractitionerRole > specialty	Specific specialty of the practitioner.	0*	CodeableConcept	n/a	This logical element has no mapping to CDA.
PractitionerRole > location	The location(s) at which this practitioner provides care.	0*	Reference(Location)	n/a	This logical element has no mapping to CDA.
PractitionerRole > healthcareSer- vice	The list of healthcare services that this worker provides for this role's Organization/Location(s).	0*	Reference(Health- careService)	n/a	Not currently mapped to CDA. See Known issues.
PractitionerRole > telecom	Contact details that are specific to the role/location/service.	0*	ContactPoint	author/assignedAuthor/telecom	In CDA the telecom for both PractitionerRole and Practitioner for an author participation are included in assignedAuthor/telecom.
					Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
PractitionerRole > availableTime	A collection of times that the Service Site is available.	0*	<u>BackboneElement</u>	n/a	This logical element has no mapping to CDA.
PractitionerRole > notAvailable	The HealthcareService is not available during this period of time due to the provided reason.	0*	BackboneElement	n/a	This logical element has no mapping to CDA.
PractitionerRole > availabilityExceptions	A description of site availability exceptions, e.g. public holiday availability. Succinctly describing all possible exceptions to normal site availability as details in the available Times and not available Times.	01	string	n/a	This logical element has no mapping to CDA.

¹Note: The source representation of this terminology binding on code in PractitionerRole with Practitioner with Mandatory Identifier [DH2020h] is as an optional slice on the <u>coding</u> part of the code element. In the representation of the model presented in this specification it is normalised as a set of preferred bindings.

8.10 custodian (Organization with Mandatory Identifier)

This template is referenced by Composition (Advance Care Planning).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Conformance level comes from	linking elements			Context: /ClinicalDocument/	
Organization	A formally or informally recognized grouping of people or	Cardinal-	Organization	custodian	
	organizations formed for the purpose of achieving some form of collective action. Includes companies, institutions,	ity comes		custodian/ templateId	The use of templateld signals the imposition of a set of
	corporations, departments, community groups, healthcare	from linking		custodian/templateId/@root="1.2.36.1.2001.1001.102.101.100002"	template-defined constraints.
practice groups, etc.	element		custodian/assignedCustodian		
				custodian/assignedCustodian/representedCustodianOrganization	
				custodian/assignedCustodian/representedCustodianOrganization/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
Organization > identifier	Identifier for the organization that is used to identify the organization across multiple disparate systems.	1*	<u>Identifier</u>	custodian/assignedCustodian/ representedCustodianOrganization/ext:asEntityIdentifier	When sending to the My Health Record, an HPI-O is expected.
					The common pattern Entity Identifier SHALL be applied.
					Recommended mappings for this logical type to CDA (R2) are available: Identifier.
Organization > active	Whether the organization's record is still in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
Organization > type	The kind(s) of organization that this is.	0*	CodeableConcept	n/a	This logical element has no mapping to CDA.
Organization > name	A name associated with the organization.	01	string	custodian/assignedCustodian/representedCustodianOrganization/name	
Organization > alias	A list of alternate names that the organization is known as, or was known as in the past.	0*	string	n/a	This logical element has no mapping to CDA.

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Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Organization > telecom	A contact detail for the organization.	0*	ContactPoint	custodian/assignedCustodian/representedCustodianOrganization/telecom	In CDA the maximum occurrences of representedCustodian- Organization/telecom is 1. Although the model indicates that telecom is 0*, in a CDA implementation this is limited to 01. telecom/@use <u>Organization Telecom Use HL7 V3</u> (re- quired) ¹ . Recommended mappings for this logical type to CDA (R2)
		-			are available: ContactPoint.
Organization > address	An address for the organization.	0*	Address	custodian/assignedCustodian/representedCustodianOrganization/ addr	addr/@use Organization Address Use HL7 V3 (required) ² . In CDA the maximum occurrences of representedCustodian-Organization/addr is 1. Although the model indicates that address is 0*, in a CDA implementation this is limited to 01. Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Organization > partOf	The organization of which this organization forms a part.	01	Reference (Base Organization)	n/a	This logical element has no mapping to CDA.
Organization > contact	Contact for the organization for a certain purpose.	0*	BackboneElement	participant[org_contact]	participant[org_contact] SHALL conform to the template defined in participant (Organization contact).

¹This value set differs from the value set bound to use in ContactPoint due to constraints on @use in the HL7 CDA Schema. The concept map v3 map for ContactPointUse provides a mapping between the two value sets.

²This value set differs from the value set bound to use in Address due to constraints on @use in the HL7 CDA schema. The concept map v3 map for AddressUse provides a mapping between the two value sets.

9 Entity CDA templates

This chapter contains the entity templates referenced by a participation template in 8 Participation CDA templates.

9.1 providerOrganization (Base Organization)

This template is referenced by recordTarget (Patient with Mandatory Identifier), and recordTarget (My Health Record Patient).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
CDA Header Data Elements				Context: /ClinicalDocument/recordTarget/patientRole/	
Organization	A formally or informally recognized grouping of people or organizations formed for the purpose of achieving some form of collective action. Includes companies, institutions, corporations, departments, community groups, healthcare practice groups, etc.	Cardinal- ity comes from linking element	Organization	providerOrganization providerOrganization/templateId	Organization SHALL have at least: • identifier (providerOrganization/ext:asEntityIdentifier), or • name (providerOrganization/name) The use of templateld signals the imposition of a set of template-defined constraints.
				providerOrganization/templateId/@root="1.2.36.1.2001.1001.102.101.100034" providerOrganization/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
Organization > identifier	Identifier for the organization that is used to identify the organization across multiple disparate systems.	0*	Identifier	providerOrganization/ext:asEntityIdentifier	The common pattern Entity Identifier SHALL be applied. Recommended mappings for this logical type to CDA (R2) are available: Identifier.
Organization > active	Whether the organization's record is still in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Organization > type	The kind(s) of organization that this is.	0*	CodeableConcept	provider Organization / standard Industry Class Code	In CDA the maximum occurrences of providerOrganization/standardIndustryClassCode is 1. Although the model indicates that code is 0*, in a CDA implementation this is limited to 01. standardIndustryClassCode/originalText or standardIndustry-ClassCode/@displayName SHALL be included. OrganizationType (example)
Organization > name	A name associated with the organization.	01	string	providerOrganization/name[org_name]	In CDA name and alias are represented by providerOrganization/name.
Organization > alias	A list of alternate names that the organization is known as, or was known as in the past.	0*	string	providerOrganization/name[alias]	In CDA name and alias are represented by providerOrganization/name.
Organization > telecom	A contact detail for the organization.	0*	ContactPoint	providerOrganization/ telecom	telecom/@use Organization Telecom Use HL7 V3 (required) ¹ . Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Organization > address	An address for the organization.	0*	Address	providerOrganization/ addr	addr/@use Organization Address Use HL7 V3 (required) ² . Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Organization > partOf	The organization of which this organization forms a part.	01	Reference(Base Or-	providerOrganization/asOrganizationPartOf	wholeOrganization SHALL conform to the template defined
		ganization)	providerOrganization/asOrganizationPartOf/wholeOrganization	in wholeOrganization (Base Organization).	
CDA Header Data Elements				Context: /ClinicalDocument/	
Organization > contact	Contact for the organization for a certain purpose.	0*	BackboneElement	participant[org_contact]	participant[org_contact] SHALL conform to the template defined in participant (Organization contact).

This value set differs from the value set bound to use in ContactPoint due to constraints on @use in the HL7 CDA Schema. The concept map v3 map for ContactPointUse provides a mapping between the two value sets.

²This value set differs from the value set bound to use in <u>Address</u> due to constraints on @use in the HL7 CDA schema. The concept map <u>v3 map for AddressUse</u> provides a mapping between the two value sets.

9.2 representedOrganization (Base Organization)

This template is referenced by author (PractitionerRole with Practitioner with Mandatory Identifier).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Conformance level comes fr	om linking elements			Context: Comes from linking elements	
organizations formed for the purpose of achieving of collective action. Includes companies, instituti	A formally or informally recognized grouping of people or organizations formed for the purpose of achieving some form of collective action. Includes companies, institutions, corporations, departments, community groups, healthcare practice groups, etc.	Cardinal- ity comes from link- ing ele- ment	Organization	representedOrganization	Organization SHALL have at least: • name (representedOrganization/name), or • identifier (representedOrganization/ext:asEntityIdentifier)
				representedOrganization/templateId	The use of templateId signals the imposition of a set of tem-
				representedOrganization/templateId/@root="1.2.36.1.2001.1001.102.101.100039"	plate-defined constraints.
				representedOrganization/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
Organization > identifier	Identifier for the organization that is used to identify the organization across multiple disparate systems.	0*	<u>Identifier</u>	representedOrganization/ext:asEntityIdentifier	The common pattern Entity Identifier SHALL be applied. Recommended mappings for this logical type to CDA (R2) are available: Identifier.
Organization > active	Whether the organization's record is still in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
Organization > type	The kind(s) of organization that this is.	0*	CodeableConcept	represented Organization / standard Industry Class Code	In CDA the maximum occurrences of representedOrganization/standardIndustryClassCode is 1. Although the model indicates that code is 0*, in a CDA implementation this is limited to 01. standardIndustryClassCode/originalText or standardIndustryClassCode/@displayName SHALL be included. OrganizationType (example)
Organization > name	A name associated with the organization.	01	string	representedOrganization/name[org_name]	In CDA name and alias are represented by representedOrganization/name.
Organization > alias	A list of alternate names that the organization is known as, or was known as in the past.	0*	string	representedOrganization/name[alias]	In CDA name and alias are represented by representedOrganization/name.

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Organization > telecom	A contact detail for the organization.	0*	ContactPoint	representedOrganization/ telecom	telecom/@use Organization Telecom Use HL7 V3 (required).
					Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Organization > address	An address for the organization.	0*	Address	representedOrganization/addr	addr/@use Organization Address Use HL7 V3 (required) ¹ .
					Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Organization > partOf	The organization of which this organization forms a part.	01	Reference(Base Or-	representedOrganization/asOrganizationPartOf	wholeOrganization SHALL conform to the template defined
			ganization)	representedOrganization/asOrganizationPartOf/wholeOrganization	in wholeOrganization (Base Organization).
CDA Header Data Elements				Context: /ClinicalDocument/	
Organization > contact	Contact for the organization for a certain purpose.	0*	<u>BackboneElement</u>	participant[org_contact]	participant[org_contact] SHALL conform to the template defined in participant (Organization contact).

¹This value set differs from the value set bound to use in Address due to constraints on @use in the HL7 CDA schema. The concept map v3 map for AddressUse provides a mapping between the two value sets.

9.3 assignedPerson (Practitioner with Mandatory Identifier)

This template is referenced by author (PractitionerRole with Practitioner with Mandatory Identifier).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Conformance level comes fro	m linking elements			Context: Comes from linking elements	
Practitioner	A person who is directly or indirectly involved in the provi-	Cardinal-	<u>Practitioner</u>	assignedPerson	
	sioning of healthcare.	ity comes		assignedPerson/templateId	The use of templateId signals the imposition of a set of
		from linking element		assignedPerson/templateId/@root="1.2.36.1.2001.1001.102.101.100040"	template-defined constraints.
Practitioner > identifier	An identifier that applies to this person in this role.	1*	Identifier	assignedPerson/ext:asEntityIdentifier	When sending to the My Health Record, an HPI-I is expected. The common pattern Entity Identifier SHALL be applied. Recommended mappings for this logical type to CDA (R2) are available: Identifier.
Practitioner > active	Whether this practitioner's record is in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
Practitioner > name	The name(s) associated with the practitioner.	0*	Base HumanName	assignedPerson/ name	The model Base HumanName is not applied to name. Recommended mappings for this logical type to CDA (R2) are available: Base HumanName.
Practitioner > telecom	A contact detail for the practitioner, e.g. a telephone number or an email address.	0*	ContactPoint	telecom	Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Practitioner > address	Address(es) of the practitioner that are not role specific (typically home address). Work addresses are not typically entered in this property as they are usually role dependent.	0*	Address	addr	Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Practitioner > gender	Administrative Gender - the gender that the person is considered to have for administration and record keeping purposes.	01	<u>code</u>	n/a	This logical element has no mapping to CDA.
Practitioner > birthDate	The date of birth for the practitioner.	01	<u>date</u>	n/a	This logical element has no mapping to CDA.

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Practitioner > qualification	Qualifications obtained by training and certification.	0*	BackboneElement	See: instantiation choices	It is possible that the qualification may be able to be captured as a complex structure or as a text list. instantiation choices: If the qualification or list of qualifications is the result of capturing a text field then qualification is expected to be instantiated as assignedPerson/ext:asQualifications/@classCode="QUAL". The common pattern Qualification SHALL be applied. If more information can be captured than a narrative list then qualification is expected to be instantiated as ext:coverage2[prac_qual] and SHALL conform to the template defined in ext:coverage2 (Practitioner qualification): • qualification for a Practitioner SHALL be instantiated in the same section e.g. qualification for an AllergyIntolerance recorder is expected to be instantiated as Clinical-Document/component/structuredBody/component[allergy]/section/ext:coverage2[prac_qual], or • qualification for a CDA Header Practitioner (e.g. Clinical-Document author) SHALL be instantiated as Clinical-Document author) SHALL be instantiated as Clinical-Document/component/structuredBody/component[admin_obs]/section/ext:coverage2[prac_qual]
Practitioner > communication	A language the practitioner is able to use in patient communication.	0*	CodeableConcept	assignedPerson/ext:languageCommunication	The common pattern Language Communication SHALL be applied.

9.4 wholeOrganization (Base Organization)

This template is referenced by participant (general Practitioner Base Organization), provider Organization (Base Organization), represented Organization (Base Organization), scoping Organization (Base Organization), and whole Organization (Base Organization).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Conformance level comes from li	nking elements			Context: Comes from linking elements	
Organization	A formally or informally recognized grouping of people or organizations formed for the purpose of achieving some form of collective action. Includes companies, institutions, corporations, departments, community groups, healthcare practice groups, etc.	Cardinality comes from link- ing ele- ment	Organization	wholeOrganization	Organization SHALL have at least: name (wholeOrganization/name), or identifier (wholeOrganization/ext:asEntityIdentifier)
				wholeOrganization/templateId	The use of templateld signals the imposition of a set of template-
				wholeOrganization/templateId/@root="1.2.36.1.2001.1001.102.101.100087"	defined constraints.
				wholeOrganization/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
Organization > identifier	Identifier for the organization that is used to identify the organization across multiple disparate systems.	0*	Identifier	wholeOrganization/ext:asEntityIdentifier	The common pattern Entity Identifier SHALL be applied. Recommended mappings for this logical type to CDA (R2) are available: Identifier.
Organization > active	Whether the organization's record is still in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
Organization > type	The kind(s) of organization that this is.	0*	CodeableConcept	wholeOrganization/standardIndustryClassCode	In CDA the maximum occurrences of wholeOrganization/standardIndustryClassCode is 1. Although the model indicates that code is 0*, in a CDA implementation this is limited to 01. standardIndustryClassCode/originalText or standardIndustryClassCode/@displayName SHALL be included. OrganizationType (example)
Organization > name	A name associated with the organization.	01	string	wholeOrganization/name[org_name]	In CDA name and alias are represented by wholeOrganization/name.
Organization > alias	A list of alternate names that the organization is known as, or was known as in the past.	0*	string	wholeOrganization/name[alias]	In CDA name and alias are represented by wholeOrganization/name.

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Organization > telecom	A contact detail for the organization.	0*	ContactPoint	wholeOrganization/telecom	telecom/@use Organization Telecom Use HL7 V3 (required) ¹ .
					Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Organization > address	An address for the organization.	0*	<u>Address</u>	wholeOrganization/addr	addr/@use Organization Address Use HL7 V3 (required) ² .
					Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Organization > partOf	The organization of which this organization forms	01	Reference(Base Or-	wholeOrganization/asOrganizationPartOf	wholeOrganization/asOrganizationPartOf/wholeOrganization SHALL
	a part.		ganization)	wholeOrganization/asOrganizationPartOf/wholeOrganization	conform to the template defined in wholeOrganization (Base Organization).
CDA Header Data Elements				Context: /ClinicalDocument/	
Organization > contact	Contact for the organization for a certain purpose.	0*	<u>BackboneElement</u>	participant[org_contact]	participant[org_contact] SHALL conform to the template defined in participant (Organization contact).

¹This value set differs from the value set bound to use in ContactPoint due to constraints on @use in the HL7 CDA Schema. The concept map v3 map for ContactPointUse provides a mapping between the two value sets.

²This value set differs from the value set bound to use in Address due to constraints on @use in the HL7 CDA schema. The concept map v3 map for AddressUse provides a mapping between the two value sets.

9.5 scopingOrganization (Base Organization)

This template is referenced by participant (Patient contact).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Conformance level comes fr	om linking elements			Context: Comes from linking elements	
Organization A formally or informally recognized grouping of people or organizations formed for the purpose of achieving some form of collective action. Includes companies, institutions, corporations, departments, community groups, healthcare practice groups, etc.	Cardinal- ity comes from link- ing ele- ment	Organization	scopingOrganization	Organization SHALL have at least: name (scopingOrganization/name), or identifier (scopingOrganization/ext:asEntityIdentifier)	
				scopingOrganization/templateId	The use of templateld signals the imposition of a set of tem-
				scopingOrganization/templateId/@root="1.2.36.1.2001.1001.102.101.100089"	plate-defined constraints.
				scopingOrganization/id	id/@root SHALL be present and it SHALL be a UUID or an OID.
Organization > identifier	Identifier for the organization that is used to identify the organization across multiple disparate systems.	0*	<u>Identifier</u>	scopingOrganization/ext:asEntityIdentifier	The common pattern Entity Identifier SHALL be applied. Recommended mappings for this logical type to CDA (R2) are available: Identifier.
Organization > active	Whether the organization's record is still in active use.	01	<u>boolean</u>	n/a	This logical element has no mapping to CDA.
Organization > type	The kind(s) of organization that this is.	0*	CodeableConcept	scopingOrganization/standardIndustryClassCode	In CDA the maximum occurrences of scopingOrganization/standardIndustryClassCode is 1. Although the model indicates that code is 0*, in a CDA implementation this is limited to 01. standardIndustryClassCode/originalText or standardIndustry-ClassCode/@displayName SHALL be included. OrganizationType (example)
Organization > name	A name associated with the organization.	01	string	scopingOrganization/name[org_name]	In CDA name and alias are represented by scopingOrganization/name.
Organization > alias	A list of alternate names that the organization is known as, or was known as in the past.	0*	string	scopingOrganization/name[alias]	In CDA name and alias are represented by scopingOrganization/name.

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Organization > telecom	A contact detail for the organization.	0*	ContactPoint	scopingOrganization/telecom	telecom/@use Organization Telecom Use HL7 V3 (required) ¹ .
					Recommended mappings for this logical type to CDA (R2) are available: ContactPoint.
Organization > address	An address for the organization.	0*	<u>Address</u>	scopingOrganization/addr	addr/@use Organization Address Use HL7 V3 (required) ² .
					Recommended mappings for this logical type to CDA (R2) are available: Address AU Base Address.
Organization > partOf	The organization of which this organization forms a part.	01	Reference(Base Or-	scopingOrganization/asOrganizationPartOf	wholeOrganization SHALL conform to the template defined
			ganization)	scopingOrganization/asOrganizationPartOf/wholeOrganization	in wholeOrganization (Base Organization).
CDA Header Data Elements				Context: /ClinicalDocument/	
Organization > contact	Contact for the organization for a certain purpose.	0*	BackboneElement	participant[org_contact]	participant[org_contact] SHALL conform to the template defined in participant (Organization contact).

¹This value set differs from the value set bound to use in ContactPoint due to constraints on @use in the HL7 CDA Schema. The concept map v3 map for ContactPointUse provides a mapping between the two value sets.

²This value set differs from the value set bound to use in Address due to constraints on @use in the HL7 CDA schema. The concept map v3 map for AddressUse provides a mapping between the two value sets.

10 Act CDA templates

This chapter contains the entry-level templates, called acts (machine readable structured content), referenced by other templates such as those in 7 Section CDA templates.

10.1 act (Advance Care Planning Document Reference)

This template is referenced by section (Advance Care Information).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Conformance level comes from li	nking elements			Context: Context: Comes from linking elements	
DocumentReference	A reference to a document.	Cardinal-	<u>DocumentReference</u>	act	
		ity comes		act/@classCode="ACT"	
	linkir	from		act/@moodCode="EVN"	
		element		act/templateId	The use of templateld signals the imposition of a set of
		1		act/templateId/@root="1.2.36.1.2001.1001.102.101.100013"	template-defined constraints.
				act/ code	
				act/code/@code="102.16971"	
				act/code/@codeSystem="1.2.36.1.2001.1001.101"	NCTIS Data Components
				act/code/@displayName	displayName SHOULD be "Related Document".
DocumentReference > author-role	Identifies the practitioner role responsible for the information in the resource (aka author), not necessarily who typed it in.	01	Reference(Practition- erRole with Practi- tioner with Mandat- ory Identifier)	act/author	author SHALL conform to the template defined in author (PractitionerRole with Practitioner with Mandatory Identifier).
DocumentReference > master- Identifier	Document identifier as assigned by the source of the document. This identifier is specific to this version of the document. This unique identifier may be used elsewhere to identify this version of the document.	01	<u>Identifier</u>	act/reference[content]/externalDocument/id[master]	

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
DocumentReference > identifier	Other identifiers associated with the document, including version independent identifiers.	0*	Identifier	See: instantiation choices	instantiation choices: The identifier element may beinstantiated as reference[content]/externalDocument/setId. The identifier element may beinstantiated as reference[content]/externalDocument/id[ident].
DocumentReference > status	The status of this document reference.	11	<u>code</u>	act/statusCode	
				act/statusCode/@code="active"	
DocumentReference > docStatus	The status of the underlying document.	01	<u>code</u>	act/entryRelationship[doc_status]	
				act/entryRelationship[doc_status]/@typeCode="COMP"	
				act/entryRelationship[doc_status]/ observation	
				act/entryRelationship[doc_status]/observation/@classCode="OBS"	
				act/entryRelationship[doc_status]/observation/@moodCode="EVN"	
				act/entryRelationship[doc_status]/observation/code	
				act/entryRelationship[doc_status]/observation/code/@code="103.20104"	
				act/entryRelationship[doc_status]/observation/code/@codeSystem= "1.2.36.1.2001.1001.101"	NCTIS Data Components
				act/entryRelationship[doc_status]/observation/code/@displayName	displayName SHOULD be "Document Status".
				act/entryRelationship[doc_status]/observation/value	value/@xsi:type SHALL be "CD". value/originalText or value/@displayName="Final" SHOULD be included.
				act/entryRelationship[doc_status]/observation/value/@code="final"	
				act/entryRelationship[doc_status]/observation/value/@codeSystem= "2.16.840.1.113883.4.642.1.237"	CompositionStatus
DocumentReference > type	Specifies the particular kind of document referenced (e.g. History and Physical, Discharge Summary, Progress Note). This usually equates to the purpose of making the document referenced.	11	CodeableConcept	act/reference[content]/externalDocument/ code	code/originalText or code/@displayName SHALL be included. Advance Care Planning Document Types (required)
DocumentReference > subject	Who or what the document is about. The document can be about a person, (patient or healthcare practitioner), a device (e.g. a machine) or even a group of subjects (such as a document about a herd of farm animals, or a set of patients that share a common exposure).	11	Reference(Patient with Mandatory Identifier My Health Record Pa- tient)	n/a	Not mapped directly for this model; this is implicit in patientRole.
DocumentReference > created	When the document was created.	01	<u>dateTime</u>	act/effectiveTime	
DocumentReference > indexed	When the document reference was created.	11	<u>instant</u>	n/a	This logical element has no mapping to CDA.

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
DocumentReference > author	Identifies who is responsible for adding the information to the document.	11	Reference(Practition- er with Mandatory Identifier Patient with Mandatory Identifier Related- Person with Mandat- ory Identifier)	act/author	In CDA an author (Practitioner) is part of an author-role; if the author is a practitioner then author-role SHALL be instantiated. author SHALL conform to a template defined in author (Patient with Mandatory Identifier) or author (RelatedPerson with Mandatory Identifier) or author (Practitioner Role with Practitioner with Mandatory Identifier).
DocumentReference > description	Human-readable description of the source document. This is sometimes known as the 'title'.	01	string	act/text	
DocumentReference > content	The document and format referenced. There may be mul-	11	<u>BackboneElement</u>	act/reference[content]	
	tiple content element repetitions, each with a different format.			act/reference[content]/@typeCode="REFR"	
				act/reference[content]/externalDocument	
				act/reference[content]/externalDocument/@classCode="DOC"	
DocumentReference > content > attachment	The document or URL of the document along with critical metadata to prove content has integrity.	11	Attachment	act/reference[content]/externalDocument/ text	The link SHALL also be present in the corresponding CDA <linkhtml> element Recommended mappings for the complex data type to CDA (R2): Attachment. text/@nullFlavor SHALL NOT be present.</linkhtml>

10.2 ext:coverage2 (Practitioner qualification)

This template is referenced by participant (generalPractitioner Base Practitioner), and assignedPerson (Practitioner with Mandatory Identifier).

See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments	
CDA Header Data Elements			•	Context: Comes from linking elements		
Practitioner > qualification	Qualifications obtained by training and	Cardinality	BackboneElement	ext:coverage2[prac_qual]		
	certification.	comes from link-		ext:coverage2[prac_qual]/@typeCode="COVBY"		
		ing ele- ment		ext:coverage2[prac_qual]/templateId	The use of templateld signals the imposition of a set of	
		ment		ext:coverage2[prac_qual]/templateId/@root="1.2.36.1.2001.1001.102.101.100038"	template-defined constraints.	
				ext:coverage2[prac_qual]/ext:entitlement		
				ext:coverage2[prac_qual]/ext:entitlement/@classCode="COV"		
				ext:coverage2[prac_qual]/ext:entitlement/@moodCode="EVN"		
				ext:coverage2[prac_qual]/ext:entitlement/ext:participant[prac]		
				ext:coverage2[prac_qual]/ext:entitlement/ext:participant[prac]/@typeCode="HLD"		
					ext:coverage2[prac_qual]/ext:entitlement/ext:participant[prac]/ext:participantRole	
				$ext:coverage 2 [prac_qual]/ext:entitlement/ext:participant[prac]/ext:participantRole/ \textbf{@classCode="ASSIGNED"} \\$		
				ext:coverage2[prac_qual]/ext:entitlement/ext:participant[prac]/ext:participantRole/ext:id	This ext:id SHALL hold the same value as practitioner that this qualification is associated with (the value in this id element SHALL be present in separate participation).	
Practitioner > qualification > identifier	An identifier that applies to this person's qualification in this role.	0*	<u>Identifier</u>	ext:coverage2[prac_qual]/ext:entitlement/ext:id	Recommended mappings for this logical type to CDA (R2) are available: Identifier.	
Practitioner > qualification > code	Coded representation of the qualification.	11	CodeableConcept	ext:coverage2[prac_qual]/ext:entitlement/ext:code	ext:code/originalText or ext:code/@displayName SHALL be included.	
					v2 table 0360, Version 2.7 (example)	
Practitioner > qualification > period	Period during which the qualification is valid.	01	<u>Period</u>	ext:coverage2[prac_qual]/ext:entitlement/ext:effectiveTime		

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Practitioner > qualification > issuer	Organization that regulates and issues the	01	Reference(Organization	ext:coverage2[prac_qual]/ext:entitlement/ext:participant[issuer]	
	qualification.			ext:coverage2[prac_qual]/ext:entitlement/ext:participant[issuer]/@typeCode="AUT"	
				ext:coverage2[prac_qual]/ext:entitlement/ext:participant[issuer]/ext:participantRole	
				ext::coverage2[prac_qual]/ext:entitlement/ext:participant[issuer]/ ext:participantRole/@classCode="COMPAR"	

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11 Common patterns

This chapter contains conformance requirements on CDA schema elements. These conformance rules apply across multiple templates, forming 'common patterns'.

11.1 Entity Identifier

See Legend - CDA mapping table for CDA schema elements for an explanation of mapping table presentation.

CDA mapping

Common pattern	CDA schema element	CDA element description	CDA card	CDA constraints and comments
Entity Identifier	ext:asEntityIdentifier	A number or code issued for the purpose of identifying a participant within a healthcare context.	Cardinality comes from linking element	
	ext:asEntityIdentifier/@classCode="IDENT"		11	
	ext:asEntityIdentifier/ ext:id		11	
	ext:asEntityIdentifier/ext:id/@root		11	root SHALL be an OID and SHALL NOT be a UUID.
	ext:asEntityIdentifier/ext:id/@extension		01	
	ext:asEntityIdentifier/ext:id/@assigningAuthorityName		01	A name for the namespace represented in the root that is populated with the issuer, or identifier type, or a concatenation of both as appropriate. This is used for human-readable, not machine processing, purposes.
				assigningAuthorityName SHOULD be instantiated.
	ext:asEntityIdentifier/ ext:code		01	
	ext:asEntityIdentifier/ext:assigningGeographicArea		01	
	ext:asEntityIdentifier/ext:assigningGeographicArea/@classCode="PLC"		11	
	ext:asEntityIdentifier/ext:assigningGeographicArea/ext:name		01	The range and extent that the identifier applies to the object with which it is associated that is populated directly from the geographic area. This is used for human-readable, not machine processing, purposes.
				ext:name SHOULD be instantiated.
				Healthcare Identifier Geographic Area (preferred)
				This CDA schema element is expected to be populated with the display, e.g. "National Identifier".

Examples

Example 11.1. Entity Identifier - Australian IHI

```
<!-- Australian IHI -->
<xs:asEntityIdentifier classCode="IDENT">
<xs:id root="1.2.36.1.2001.1003.0.8003608833357361" assigningAuthorityName="IHI" />
 <xs:assigningGeographicArea classCode="PLC">
     <xs:name>National Identifier</xs:name>
  </xs:assigningGeographicArea>
</xs:asEntityIdentifier>
```

Example 11.2. Entity Identifier - Local Medical Record Number

```
<!-- Local Medical Record Number -->
<xs:asEntityIdentifier classCode="IDENT">
<xs:id root="1.2.36.1.2001.1005.29.8003621566684455" extension="542181" assigningAuthorityName="Croydon GP Centre" />
  <xs:code code="MR" codeSystem="2.16.840.1.113883.12.203" codeSystemName="Identifier Type (HL7)" />
</xs:asEntityIdentifier>
```

Example 11.3. Entity Identifier - Australian HPI-I

```
<!-- Australian HPI-I -->
<xs:asEntityIdentifier classCode="IDENT">
<xs:id assigningAuthorityName="HPI-I" root="1.2.36.1.2001.1003.0.8003610537409456"/>
<xs:assigningGeographicArea classCode="PLC">
 <xs:name>National Identifier</xs:name>
</xs:assigningGeographicArea>
</xs:asEntityIdentifier>
```

Example 11.4. Entity Identifier - Australian HPI-O

```
<!-- Australian HPI-O -->
<xs:asEntityIdentifier classCode="IDENT">
  <xs:id assigningAuthorityName="HPI-O" root="1.2.36.1.2001.1003.0.8003621566684455" />
  <xs:assigningGeographicArea classCode="PLC">
     <xs:name>National Identifier</xs:name>
  </xs:assigningGeographicArea>
</xs:asEntityIdentifier>
```

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11.2 Personal Relationship

See Legend - CDA mapping table for CDA schema elements for an explanation of mapping table presentation.

CDA mapping

Common pattern	CDA schema element	CDA element description	CDA card	CDA constraints and comments
Personal Relationship	ext:personalRelationship	The personal relationship of a participant to a patient. A personal relationship is not to be instantiated if the participant is a practitioner.	Cardinality comes from link- ing element	
	ext:personalRelationship/@classCode="PRS"		01	
	ext:personalRelationship/ext:id		01	
	ext:personalRelationship/ext:code		11	
	ext:personalRelationship/ext:statusCode		01	v3 Code System RoleStatus (required)
	ext:personalRelationship/ext:effectiveTime		01	
	ext:personalRelationship/ext:asPersonalRelationship		11	
	ext:personalRelationship/ext:asPersonalRelationship/@classCode="PSN"		01	
	ext:personalRelationship/ext:asPersonalRelationship/@determinerCode="INSTANCE"		01	
	ext:personalRelationship/ext:asPersonalRelationship/id		11	This id SHALL hold the same value as patientRole/id.
	ext:personalRelationship/ext:asPersonalRelationship/administrativeGenderCode/@nullFlavor="NA"		11	Included for CDA conformance only.

Examples

Example 11.5. Personal Relationship - author related person

```
<!-- recordTarget (Patient) -->
<recordTarget>
  <patientRole>
     <!-- patient identifier-->
     <id extension="100543" root="2.16.840.1.113883.19.1.2.3.4"/>
  </patientRole>
</recordTarget>
<!-- author (RelatedPerson) -->
<author>
   <time value="200911031647+1000"/>
   <assignedAuthor>
     <!-- author identifier-->
     <id root="86d729b8-72d2-460a-a64c-489a51607450"/>
      <assignedPerson>
        <!-- personal relationship -->
        <ext:personalRelationship>
           <!--relationship-->
           <ext:code code="SIGOTHR" codeSystem="2.16.840.1.113883.5.111" codeSystemName="v3 Code System RoleCode" displayName="significant other" />
           <!--patient-->
            <ext:asPersonalRelationship>
              <!-- patient identifier-->
              <id extension="100543" root="2.16.840.1.113883.19.1.2.3.4"/>
              <administrativeGenderCode nullFlavor="NA" />
            </ext:asPersonalRelationship>
        </ext:personalRelationship>
      </assignedPerson>
   </assignedAuthor>
</author>
```

Example 11.6. Personal Relationship - performer related person

```
<!-- recordTarget (Patient) -->
<recordTarget>
   <patientRole>
     <!-- patient identifier-->
     <id extension="100543" root="2.16.840.1.113883.19.1.2.3.4"/>
  </patientRole>
</recordTarget>
<!-- participant performer (RelatedPerson) -->
<participant typeCode="PRF">
  <associatedEntity classCode="ASSIGNED">
     <!--participant performer identifier-->
     <id root="f3351b5c-8a6c-437c-a55c-a6c121873456"/>
      <!-- personal relationship -->
      <associatedPerson>
        <ext:personalRelationship>
           <!--relationship-->
            <ext:code code="FAMMEMB" codeSystem="2.16.840.1.113883.5.111" codeSystemName="v3 Code System RoleCode" displayName="Family Member" />
```

THIS SPECIFICATION IS UNTESTED AND IS NOT SUITABLE FOR IMPLEMENTATION.

11.3 Qualification

See Legend - CDA mapping table for CDA schema elements for an explanation of mapping table presentation.

CDA mapping

	Common pattern	CDA schema element	CDA element description	CDA card	CDA constraints and comments
	Qualification	ext:asQualifications	A list of professional certifications, and certificates recognising having passed a course.	Cardinality comes from linking element	
ext:asQualifications/@classCode="QUAL"			11		
		ext:asQualifications/ext:code		11	Qualifications is a text field, so the text list is captured in ext:code/originalText.

Examples

Example 11.7. Qualification - Bachelor of Pharmacy

```
<!-- Qualification - Bachelor of Pharmacy -->
<ext:asQualifications classCode="QUAL">
<ext:code>
  <originalText>Bachelor of Pharmacy</originalText>
  </ext:code>
</ext:asQualifications>
```

Example 11.8. Qualification - List of qualifications

```
<!-- Qualification -->
<ext:asQualifications classCode="QUAL">
<ext:code>
<originalText>Doctor of Medicine, Fellowship of the Australian College of Rural and Remote Medicine (FACRRM)</originalText>
</ext:code>
</ext:asQualifications>
```

11.4 Language Communication

See Legend - CDA mapping table for CDA schema elements for an explanation of mapping table presentation.

CDA mapping

Common pattern	CDA schema element	CDA element description	CDA card	CDA constraints and comments
Language Communication	ext:languageCommunication	A language communication capability of an individual.	Cardinality comes from linking ele- ment	
	ext:languageCommunication/languageCode		11	This CDA schema element is of type CodedSimpleValue (CS).
				All Languages (required)
				Common Languages in Australia (extensible)
	ext:languageCommunication/modeCode		01	v3 Code System LanguageAbilityMode (preferred)
	ext:languageCommunication/proficiencyLevelCode		01	v3 Code System LanguageAbilityProficiency (preferred)
	ext:languageCommunication/preferenceInd		01	This CDA schema element is of type Boolean (BL).

Examples

Example 11.9. Language Communication - English is preferred

```
<!-- Language Communication -->
<ext:languageCommunication>
<languageCode code="en"/>
<preferenceInd value="true"/>
</ext:languageCommunication>
```

Example 11.10. Language Communication - Pitjantjatjara is preferred

```
<!-- Language Communication -->
<ext:languageCommunication>
<languageCode code="pjt"/>
</ext:languageCommunication>
```

Example 11.11. Language Communication - German is spoken

```
<!-- Language Communication -->
<ext:languageCommunication>
<languageCode code="de"/>
</ext:languageCommunication>
```

Appendix A. Complex data type mappings to CDA (R2)

This informative appendix provides some guidance on how *FHIR Release 3 (STU)* [HL7FHIR3] complex data types referred to in the body of this specification can map to CDA (R2). The material provided are recommendations and do not represent conformance requirements.

A.1 Identifier

This informative appendix provides some guidance on how the complex data type <u>Identifier</u> can map to CDA (R2). In addition to material provided in this implementation guide some guidance on representation of common identifiers in CDA is provided by *Representation of Common Australian Identifiers in v2 and CDA [HI2011]* and *Common - Clinical Document [DH2019a]*.

The mapping table below provides a set of preferred mappings to the InstanceIdentifier (II) data type [HL7V3] and the Entity Identifier (EntityIdentifier) type defined in the Australian Digital Health Agency CDA schema, and do not represent conformance requirements. See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Identifier	A technical identifier - identifies some entity uniquely and unambiguously.	Cardinal- ity comes from link- ing ele- ment	Element	See: instantiation choices	In CDA it is possible that an identifier is formed such that the system and value are both part of the value of the root attribute. In this circumstance the extension attribute SHOULD NOT be instantiated. instantiation choices: If the identifier is for a Patient, Practitioner, PractitionerRole, Organization, RelatedPerson, or Device, then the identifier is expected to be instantiated as ext:asEntityIdentifier/@classCode="IDENT". See <entity identifier=""> for available attributes. The identifier element may be instantiated as id.</entity>
Identifier > use	The purpose of this identifier.	01	<u>code</u>	n/a	This logical element has no mapping to CDA.
Identifier > type	A coded type for the identifier that can be used to determine which identifier to use for a specific purpose.	01	CodeableConcept	//ext:asEntityIdentifier/ext:code	ext:code is only available if the identifier is instantiated as ext:asEntityIdentifier/@classCode="IDENT". ext:code/originalText or ext:code/@displayName SHALL be included. Identifier Type Codes (extensible)
Identifier > system	Establishes the namespace for the value - that is, a URL that describes a set values that are unique.	01	uri	See: instantiation choices	instantiation choices: If the identifier is for a If the identifier is for a Patient, Practitioner, PractitionerRole, Organization, RelatedPerson, or Device, then the identifier system is expected to be instantiated as ext:asEntity-Identifier/ext:id/@root. The identifier system may be instantiated as id/@root.
Identifier > value	The portion of the identifier typically relevant to the user and which is unique within the context of the system.	01	string	See: instantiation choices	instantiation choices: If the identifier is for a If the identifier is for a Patient, Practitioner, PractitionerRole, Organization, RelatedPerson, or Device, then identifier value is expected to be instantiated as ext:asEntityIdentifier/ext:id/@extension. The identifier value may be instantiated as id/@extension.

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Identifier > period	Time period during which identifier is/was valid for use.	01	<u>Period</u>	n/a	This logical element has no mapping to CDA.
Identifier > assigner	Organization that issued/manages the identifier.	01	Reference (Organization)	See: instantiation choices	instantiation choices: If the identifier is for a <u>Patient, Practitioner, PractitionerRole, Organization, RelatedPerson</u> , or <u>Device</u> , then identifier assigner is expected to be instantiated as ext:asEntityIdentifier/ext:id/@assigningAuthorityName. The identifier assigner may be instantiated as id/@assigningAuthorityName.

Examples

Example A.1. Identifier - Patient identifiers

```
<!-- subject -->
<recordTarget>
   <!-- subject (Patient) -->
   <patientRole>
       <patient>
           <!-- Patient.identifier as an Australian IHI -->
           <ext:asEntityIdentifier classCode="IDENT">
               <!-- identifier.type.text=IHI,
               identifier.value=8003600200002222,
               identifier.system=http://ns.electronichealth.net.au/id/hi/ihi/1.0 -->
                <ext:id assigningAuthorityName="IHI" root="1.2.36.1.2001.1003.0.8003600200002222" />
               <ext:assigningGeographicArea classCode="PLC">
                   <ext:name>National Identifier</ext:name>
                </ext:assigningGeographicArea>
           </ext:asEntityIdentifier>
            <!-- Patient.identifier as an Institution Medical Record-->
           <ext:asEntityIdentifier classCode="IDENT">
            <!-- identifier.assigner=Croyden GP Centre,
               identifier.value=542181,
               identifier.system=urn:oid:1.2.36.1.2001.1005.29.8003621566684455 -->
             <ext:id root="1.2.36.1.2001.1005.29.8003621566684455" extension="542181" assigningAuthorityName="Croydon GP Centre" />
            <!-- Patient.identifier.type -->
            <ext:code code="MR" codeSystem="2.16.840.1.113883.12.203" codeSystemName="Identifier Type (HL7)" />
            </ext:asEntityIdentifier>
           <!-- Patient.identifier as a Medicare Number -->
           <ext:asEntityIdentifier classCode="IDENT">
            <!-- identifier.system=urn:oid:1.2.36.1.5001.1.0.7,
               identifier.value=123456789,
               identifier.assigner=Medciare Card Number -->
             <ext:id assigningAuthorityName="Medicare Card Number"
             root="1.2.36.1.5001.1.0.7" extension="1234567892"/>
             <ext:code code="MC" codeSystem="2.16.840.1.113883.12.203"</pre>
             codeSystemName="Identifier Type (HL7)" displayName="Patient's Medicare number"/>
```

```
<!-- Identifier.period is not available in an asEntityIdentifier class -->
            </ext:asEntityIdentifier>
            <!-- Patient.identifier as a DVA Number -->
            <ext:asEntityIdentifier classCode="IDENT">
            <!-- identifier.system=urn:oid:2.16.840.1.113883.3.879.270091,
               identifier.value=NBUR9080,
               identifier.assigner=Department of Veterans' Affairs -->
            <ext:id assigningAuthorityName="Department of Veterans' Affairs"
             root="2.16.840.1.113883.3.879.270091" extension="NBUR9080"/>
            <ext:code code="DVG" codeSystem="2.16.840.1.113883.2.3.4.1.1.203"</pre>
             codeSystemName="HL7V2Table0203IdentifierTypeAUExtended" displayName="DVA Gold Card Number"/>
            <!-- Identifier.period is not available in an asEntityIdentifier class -->
            </ext:asEntityIdentifier>
           <!-- Patient.identifier as a Healthcare card number -->
            <ext:asEntityIdentifier classCode="IDENT">
            <!-- identifier.system=urn:oid:2.16.840.1.113883.3.879.270098,
               identifier.value=307111942H.
               identifier.assigner=Centrelink customer reference number -->
            <ext:id assigningAuthorityName="Centrelink customer reference number"</pre>
             root="2.16.840.1.113883.3.879.270098" extension="307111942H"/>
            <ext:code code="HC" codeSystem="2.16.840.1.113883.12.203"</pre>
             codeSystemName="Identifier Type (HL7)" displayName="Health Card Number"/>
            </ext:asEntityIdentifier>
       </patient>
   </patientRole>
</recordTarget>
```

Example A.2. PractitionerRole identifiers

```
<time value="200911031647+1000"/>
<!-- author (PractitionerRole) -->
<assignedAuthor>
    <!-- PractitionerRole.id -->
   <id root="86d729b8-72d2-460a-a64c-489a51607450"/>
   <!-- PractitionerRole.practitioner(Practitioner) -->
    <assignedPerson>
        <!-- Practitioner.identifier as an Australian HPI-I -->
        <ext:asEntityIdentifier classCode="IDENT">
           <!-- identifier.value=8003610537409456,
           identifier.system=urn:oid:1.2.36.1.2001.1003.0,
           identifier.assigner=HPI-I -->
            <ext:id assigningAuthorityName="HPI-I"</pre>
               root="1.2.36.1.2001.1003.0.8003610537409456"/>
            <ext:assigningGeographicArea classCode="PLC">
               <ext:name>National Identifier</ext:name>
            </ext:assigningGeographicArea>
        </ext:asEntityIdentifier>
        <!-- PractitionerRole.identifier as an ABN scoped provider identifier -->
        <ext:asEntityIdentifier classCode="IDENT">
         <!-- identifier.value=8003610537409456,
           identifier.system=urn:oid:1.2.36.1.2001.1003.0,
            identifier.assigner=HPI-I -->
            <ext:id assigningAuthorityName="Albion Hospital",
```

```
root="1.2.36.1.2001.1005.70.51824753556"
               extension="peterwinslow44"/>
               <!-- identifier.type -->
               <ext:code code="EI"
                   codeSystem="2.16.840.1.113883.18.108"
                   codeSystemName="v2 Identifier Type"
                   displayName="Employee number"/>
           </ext:asEntityIdentifier>
       </assignedPerson>
   </assignedAuthor>
   <!--PractitionerRole.organization (Organization)-->
   <representedOrganization>
       <!-- Organization.name -->
       <name>Albion Hospital</name>
       <!--Organization.identifier as an ABN-->
       <ext:asEntityIdentifier classCode="IDENT">
           <!-- identifier.value=51824754455,
           identifier.svstem=urn:oid:1.2.36.
           identifier.assigner=ABN -->
           <ext:id root="1.2.36.51824754455" assigningAuthorityName="ABN"/>
            <!-- identifier.type -->
           <ext:code code="XX"
               codeSystem="2.16.840.1.113883.12.203" />
       </ext:asEntityIdentifier>
   </representedOrganization>
</author>
```

Example A.3. Identifier - Organization identifier

```
<custodian>
   <!-- custodian (Organization)-->
   <assignedCustodian>
       <representedCustodianOrganization>
           <!-- Organization.id-->
           <id root="d0455def-ff37-4ebe-97fb-52db7224b148"/>
           <!-- Organization.identifier as a Laboratory NATA Identifier -->
           <ext:asEntityIdentifier classCode="IDENT">
               <!-- identifier.system.value=urn:oid:1.2.36.1.2001.1005.12,
               identifier.value=2184,
               identifier.assigner=NATA -->
               <ext:id assigningAuthorityName="NATA"</pre>
                   root="1.2.36.1.2001.1005.12" extension="2184"/>
               <!-- identifier.type -->
               <ext:code code="XX" codeSystem="2.16.840.1.113883.12.203"/>
           </ext:asEntityIdentifier>
       </representedCustodianOrganization>
   </assignedCustodian>
</custodian>
```

Example A.4. Identifier - ProcedureRequest identifier

```
<!--DiagnosticReport.basedOn-->
<inFulfillmentOf typeCode="FLFS">
```

A.2 Base HumanName

This informative appendix provides some guidance on how the constrained form of complex data type <u>HumanName</u> as Base HumanName published by the Australian Digital Health Agency can map to CDA (R2).

The mapping table below provides a set of preferred mappings to the PersonName (PN) data type [HL7V3] for representing an Australian address and do not represent conformance requirements. See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
HumanName	A human's name with the ability to identify parts and usage.	Cardinality comes from linking ele- ment	Element	//name	name SHALL have at least text (name with full text representation) or family (name/family) or given (name/given) instantiated. In CDA, a full text representation of a name is not to be included in the same instance as a structured representation with the same name parts. Either the free text representation or a name with structure (e.g. name/family or name/given) should be provided but not both.
HumanName > use	Identifies the purpose for this name.	01	<u>code</u>	//name/@use	Common Person Name Use (required) ¹
HumanName > text	A full text representation of the name.	01	string	//name	
HumanName > family	The part of a name that links to the genealogy. In some cultures (e.g. Eritrea) the family name of a son is the first name of his father.	01	string	//name/ family	
HumanName > given	Given name.	0*	string	//name/given	
HumanName > prefix	Part of the name that is acquired as a title due to academic, legal, employment or nobility status, etc. and that appears at the start of the name.	0*	string	//name/prefix	A prefix value can be populated as described in AS 4846 (2014) — Person and provider identification in healthcare [SA2014a], 4.4.2 Name Title.
HumanName > suffix	Part of the name that is acquired as a title due to academic, legal, employment or nobility status, etc. and that appears at the end of the name.	0*	string	//name/suffix	A suffix value can be populated as described in AS 4846 (2014) — Person and provider identification in healthcare [SA2014a], 4.5.3.2 Name Suffix.
HumanName > period	Indicates the period of time when this name was valid for the named person.	01	<u>Period</u>	//name/validTime	

¹This value set differs from the value set bound to use in HumanName due to constraints on @use in the HL7 CDA Schema. The concept map NameUse (HL7 FHIR) to Common Person Name Use provides a mapping between the two value sets.

Examples

Example A.5. Base HumanName - name use, given names, family name

```
<!-- HumanName where use=official -->
<name use="C">
   <!-- HumanName.given -->
   <given>Adam</given>
   <!-- HumanName.given -->
   <given>A.</given>
   <!-- HumanName.family -->
   <family>Everyman</family>
```

Example A.6. Base HumanName - unstructured name

```
<!-- HumanName where use=official -->
<name use="C">
   <!-- HumanName.text -->
   Adam A. Everyman
</name>
```

Example A.7. Base HumanName - given name only

```
<!-- HumanName where use=usual -->
<name>
   <!-- HumanName.given -->
   <given>Damo</given>
</name>
```

Example A.8. Base HumanName - structured name with period

```
<!-- HumanName where use=old -->
<name use="DN">
   <!-- HumanName.given -->
   <given>Adam</given>
   <!-- HumanName.given -->
   <given>A.</given>
   <!-- HumanName.family -->
   <family>Adamson</family>
   <!-- HumanName.period -->
   <validTime xsi:type="IVL_TS">
       <low value="01012001" />
       <high value="01012012" />
```

THIS SPECIFICATION IS UNTESTED AND IS NOT SUITABLE FOR IMPLEMENTATION.

</randalidTime>

A.3 Address

This informative appendix provides some guidance on how the complex data type Address can map to CDA (R2).

The mapping table below provides a set of preferred mappings to the PostalAddress (AD) data type [HL7V3] and do not represent conformance requirements. See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Address	An address expressed using postal conventions (as opposed to GPS or other location definition formats). This data type may be used to convey addresses for use in delivering mail as well as for visiting locations which might not be valid for mail delivery. There are a variety of postal address formats defined around the world.	Cardinality comes from linking ele- ment	Element	//addr	
Address > use	The purpose of this address.	01	code	//addr/@use	addr/@use can carry more than one value by a space separated list of codes. Address Use HL7 v3 (required) ¹
Address > type	Distinguishes between physical addresses (those you can visit) and mailing addresses (e.g. PO Boxes and care-of addresses). Most addresses are both.	01	code	//addr/@use	addr/@use can carry more than one value by a space separated list of codes. Address Type HL7 v3 (required) ²
Address > text	A full text representation of the address.	01	string	//addr	The expectation is that this is free text.
Address > line	This component contains the house number, apartment number, street name, street direction, P.O. Box number, delivery hints, and similar address information.	0*	string	//addr/streetAddressLine	
Address > city	The name of the city, town, village or other community or delivery center.	01	string	//addr/ city	
Address > district	The name of the administrative area (county).	01	string	//addr/county	
Address > state	Sub-unit of a country with limited sovereignty in a federally organized country. A code may be used if codes are in common use (i.e. US 2 letter state codes).	01	string	//addr/state	
Address > postalCode	A postal code designating a region defined by the postal service.	01	string	//addr/ postalCode	
Address > country	Country - a nation as commonly understood or generally accepted.	01	string	//addr/country	Iso 3166 Part 1: 2 Letter Codes (preferred)
Address > period	Time period when address was/is in use.	01	<u>Period</u>	//addr/useablePeriod	

¹This value set differs from the value set bound to use in Address due to constraints on @use in the HL7 CDA schema. The concept map v3 map for AddressUse provides a mapping between the two value sets.

Examples

Example A.9. Address - structured work and postal address

```
<!-- Address where use=work and type=postal -->
<addr use="PST WP">
   <!--Address.text-->
   1050 W Wishard Blvd
   5th floor
    Indianapolis, IN 46240
    <!--Address.line-->
    <streetAddressLine>1050 W Wishard Blvd</streetAddressLine>
    <!--Address.line-->
    <streetAddressLine>RG 5th floor</streetAddressLine>
    <!--Address.city-->
    <city>Indianapolis</city>
   <!--Address.state-->
    <state>IN</state>
    <!--Address.postalCode-->
    <postalCode>46240</postalCode>
</addr>
```

Example A.10. Address - structured home and physical address

Example A.11. Address - temporary international address

```
<!-- Address where use=old -->
<addr use="TMP">
  <!--Address.line-->
  <streetAddressLine>Rue Lougoraïa 12, app. 10</streetAddressLine>
```

²This value set differs from the value set bound to type in Address due to constraints on @use in the HL7 CDA schema. The concept map v3 map for AddressType provides a mapping between the two value sets.

```
<!--Address.city-->
   <city>Korolevo</city>
   <!--Address.state-->
   <state>Minsk</state>
   <!--Address.country-->
   <country>BELARUS</country>
   <!--Address.period-->
   <useablePeriod xsi:type="IVL_TS">
       <le><low value="01012001" />
       <high value="01012012" />
   </useablePeriod>
</addr>
```

A.4 AU Base Address

This informative appendix provides some guidance on how the constrained form of complex data type Address as AU Base Address published by HL7 Australia can map to CDA (R2).

The mapping table below provides a set of preferred mappings to the PostalAddress (AD) data type [HL7V3] for representing an Australian address and do not represent conformance requirements. See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Address	An Australian address expressed using postal conventions (as opposed to GPS or other location definition formats).	Cardinality comes from linking ele- ment	Element	//addr	addr SHALL have text or one or more line (addr/streetAddressLine).
Address > no-fixed-address	No fixed address indicator.	01	boolean	n/a	Not mapped directly; if 01 is "true", addr SHOULD be "NO FIXED ADDRESS" and addr/@use SHOULD be "PHYS".
Address > use	The purpose of this address.	01	code	//addr/@use	addr/@use can carry more than one value by a space separated list of codes. Address Use HL7 v3 (required) ¹
Address > type	Distinguishes between physical addresses (those you can visit) and mailing addresses (e.g. PO Boxes and care-of addresses). Most addresses are both.	01	code	//addr/@use	addr/@use can carry more than one value by a space separated list of codes. Address Type HL7 v3 (required) ²
Address > text	A full text representation of the address.	01	string	//addr	The expectation is that this is free text.
Address > line	This component contains the house number, apartment number, street name, street direction, P.O. Box number, delivery hints, and similar address information.	0*	string	//addr/streetAddressLine	
Address > city	The name of the city, town, village or other community or delivery center.	01	string	//addr/ city	
Address > district	The name of the administrative area (county).	01	string	//addr/county	
Address > state	Sub-unit of a country with limited sovereignty in a federally organized country. A code may be used if codes are in common use (i.e. US 2 letter state codes).	01	string	//addr/state	state SHALL be populated with the code e.g. "NT". <u>Australian States and Territories</u> (required)
Address > postalCode	A postal code designating a region defined by the postal service.	01	string	//addr/postalCode	The maximum length of postalCode SHALL be 4.

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
Address > country	Fixed value if present otherwise assumed to be Australia in this context.	01	string	//addr/ country	country SHALL be "AU".
Address > period	Time period when address was/is in use.	01	Period	//addr/useablePeriod	

¹This value set differs from the value set bound to use in AU Base Address due to constraints on @use in the HL7 CDA schema. The concept map v3 map for AddressUse provides a mapping between the two value sets.

Examples

Example A.12. AU Base Address - no fixed address in Melbourne, VIC

```
<!-- Australian Address with no fixed address in Melbourne, VIC-->
<addr use="PHYS">
<!--Address.text-->
NO FIXED ADDRESS
<!--Address.city-->
<city>Melbourne</city>
<!--Address.state-->
<state>VIC</state>
</addr>
```

Example A.13. AU Base Address - unstructured address

```
<!-- Australian Address with only text-->
<addr use="PHYS">
<!--Address.text-->
Level 1, 300 George St, Brisbane, QLD 4000
</addr>
```

Example A.14. AU Base Address - structured postal address with period

```
<!-- Australian Address where use=work and type=postal -->
<addr use="PST WP">
<!--Address line-->
<streetAddressLine>Northern Territory Office, Department of Addresses, GPO Box 19132110/streetAddressLine>
<!--Address.city-->
<city>Darwin</city>
<!--Address.state-->
<state>NT</state>
<!--Address.postalCode-->
<postalCode>0801</postalCode>
<!--Address.country-->
```

²This value set differs from the value set bound to type in <u>AU Base Address</u> due to constraints on @use in the HL7 CDA schema. The concept map <u>v3 map for AddressType</u> provides a mapping between the two value sets.

```
<country>AU</country>
<!--Address.period-->
<useablePeriod xsi:type="IVL_TS">
<low value="200311031647+1000" />
</useablePeriod>
</addr>
```

Example A.15. AU Base Address - structured physical address

```
<!-- Australian Address where use=work and type=physical -->
<addr use="PHYS WP">
<!--Address.line-->
<streetAddress.line->
<streetAddress.line>5th Floor, Northern Territory House, 223 Mitchell Street</streetAddressLine>
<!--Address.city-->
<city>Darwin</city>
<!--Address.state-->
<state>NT</state>
<!--Address.postalCode-->
<postalCode>0800</postalCode>
<!--Address.country-->
<country>AU</country>
</addr>
```

A.5 ContactPoint

This informative appendix provides some guidance on how the complex data type ContactPoint can map to CDA (R2).

The mapping table below provides a set of preferred mappings to the TelecommunicationAddress (TEL) data type [HL7V3] and do not represent conformance requirements. See Legend - CDA mapping table for logical elements for an explanation of mapping table presentation.

CDA mapping

Logical element	Logical element description	Logical card	Logical type	CDA schema element	CDA constraints and comments
ContactPoint	Details for all kinds of technology mediated contact points for a person or organization, including telephone, email, etc.	Cardinality comes from linking ele- ment	Element	//telecom	In CDA, ContactPoint value and system are represented as parts of telecom/@value. If ContactPoint value is present, ContactPoint system SHALL be present.
ContactPoint > system	Telecommunications form for contact point - what communications system is required to make use of the contact.	01	code	//telecom/@value	Makes up part of the attribute: "system:value", e.g. "tel:phone number", "mailto:email address", "http:URL", etc. HL7 URLScheme (required)
ContactPoint > value	The actual contact point details, in a form that is meaningful to the designated communication system (i.e. phone number or email address).	01	string	//telecom/@value	Makes up the part of the attribute: "system:value", e.g. "tel:phone number", "mailto:email address", "http:URL", etc.
ContactPoint > use	Identifies the purpose for the contact point.	01	code	//telecom/@use	HL7 TelecommunicationAddressUse (required) ¹
ContactPoint > rank	Specifies a preferred order in which to use a set of contacts. Contacts are ranked with lower values coming before higher values.	01	positiveInt	n/a	This logical element has no mapping to CDA.
ContactPoint > period	Time period when the contact point was/is in use.	01	<u>Period</u>	//telecom/usablePeriod	

¹This value set differs from the value set bound to use in ContactPoint due to constraints on @use in the HL7 CDA Schema. The concept map v3 map for ContactPointUse provides a mapping between the two value sets.

Examples

Example A.16. ContactPoint - home telephone with period

```
<!-- ContactPoint where system=phone, value=+1-(03)5550-1212, use=home -->
<telecom value="tel:+1-(03)5550-1212" use="H">
     <!-- ContactPoint.period -->
```

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Example A.17. ContactPoint - home telephone

```
<!-- ContactPoint where system=phone, value=0755501234, use=home --> <telecom use="H" value="tel:0755501234" />
```

Example A.18. ContactPoint - work email

```
<!-- ContactPoint where system=email, value=sfranklin@amail.example.com, use=work -->
<telecom use="WP" value="mailto:sfranklin@amail.com.au" />
```

A.6 Attachment

This informative appendix provides some guidance on how the complex data type <u>Attachment</u>, referenced in the body of this specification can map to CDA (R2). The mapping table below provides a set of preferred mappings and do not represent conformance requirements.

CDA mapping

Logical element	Logical element description	Logic- al card	Logical type	CDA schema element	CDA constraints and comments
Attachment	For referring to data content defined in other formats.	Cardinal- ity comes from link- ing ele- ment	Element	n/a	In CDA this is equivalent to the data type EncapsulatedData (ED). If data is present, contentType SHALL be present.
Attachment > contentType	Identifies the type of the data in the attachment and allows a method to be chosen to interpret or render the data. Includes mime type parameters such as charset where appropriate.	01	code	//mediaType	This CDA schema element is of type CodedSimpleValue (CS). MimeType (required) The preferred value set for HL7 CDA is defined in HL7 Version 3 Standard [HL7V3] but may be further constrained by Clinical Documents Common Conformance Profile [DH20170].
Attachment > language	The human language of the content. The value can be any valid value according to BCP 47.	01	<u>code</u>	//language	This CDA schema element is of type CodedSimpleValue (CS). Common Languages in Australia (extensible)
Attachment > data	The actual data of the attachment - a sequence of bytes. In XML, represented using base64.	01	base64Binary	//@representation="B64" n/a	In CDA, the inline data is included as part of the encapsulated data value (e.g. between the opening and closing XML tags) of the CDA schema element.
Attachment > url	An alternative location where the data can be accessed.	01	uri	//reference //reference/@value	
Attachment > size	The number of bytes of data that make up this attachment (before base64 encoding, if that is done).	01	unsignedInt	n/a	This logical element has no mapping to CDA.
Attachment > hash	The calculated hash of the data using SHA-1. Represented using base64.	01	base64Binary	//integrityCheck //integrityCheckAlgorithm	This CDA schema element is of type CodedSimpleValue (CS).
Attachment > title	A label or set of text to display in place of the data.	01	string	n/a	This logical element has no mapping to CDA. In CDA, attachment title may be captured in the parent act and/or section narrative.
Attachment > creation	The date that the attachment was first created.	01	dateTime	n/a	This logical element has no mapping to CDA. In CDA, attachment creation may be captured in the parent act and/or section narrative.

Examples

Example A.19. Attachment - diagnostic report pdf

Example A.20. Attachment - base64 representation

Example A.21. Attachment - anatomical image jpeg

THIS SPECIFICATION IS UNTESTED AND IS NOT SUITABLE FOR IMPLEMENTATION.

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10 March 2020 DH-XXXX:2019

Appendix B. Examples

This implementation guide is intended to support multiple usage scenarios; some templates described within this implementation guide are reused across usage scenarios and other implementation guides.

This informative appendix provides examples that conform to the CDA templates defined in this implementation guide to support implementation by demonstrating one or more supported usage scenarios.

Example	Context	Usage Scenario(s)
Advance Care Planning example 1	TBD	TBD
Advance Care Planning example 2	TBD	TBD
Advance Care Planning example 3	TBD	TBD

A corresponding set of FHIR Release 3 (STU) examples, conforming to the FHIR profiles used as logical models for this CDA implementation guide, are available in the *Advance Care Records FHIR Implementation Guide* [DH2020h].

B.1 Advance Care Planning example 1

This informative appendix provides an example CDA instance that conforms to the requirements of this implementation guide.

Example B.1. Advance Care Plan Level example 1

```
This example is illustrative only. This fragment cannot be treated as clinically valid.
While every effort has been taken to ensure that the examples are consistent with the message specification, where
there are conflicts with the written message specification or schema, the specification or schema will take precedence. -->
<ClinicalDocument classCode="DOCCLIN" moodCode="EVN" xmlns="urn:hl7-org:v3" xmlns:ex="urn:hl7-org/v3-example"</pre>
 xmlns:ext="http://ns.electronichealth.net.au/Ci/Cda/Extensions/3.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="urn:h17-org:v3 .
ctypeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040" />
 <!-- ClinicalDocument templateId -->
<templateId root="1.2.36.1.2001.1001.102.101.100033" extension="1.0"/>
 <!--Advance Care Planning document model templateId -->
<templateId root="1.2.36.1.2001.1001.102.101.100016" extension="1.0"/>
 <!--CDA Rendering Specification templateId-->
<templateId root="1.2.36.1.2001.1001.100.226" extension="1.0" />
<id root="2.25.134045617645909421812767683577428735500" />
 <code code="100.16975" codeSystem="1.2.36.1.2001.1001.101" codeSystemName="NCTIS Data Components" displayName="Advance Care Planning"/>
 <title>Advance Care Planning Document</title>
 <effectiveTime value="20170621090015+1000"
<confidentialityCode nullFlavor="NA" />
 <ext:completionCode code="F" codeSystem="1.2.36.1.2001.1001.101.104.20104" codeSystemName="NCTIS Document Status Values" displayName="Final" />
 <!-- subject (Patient with mandatory identifier) -->
 <recordTarget typeCode="RCT">
    <templateId root="1.2.36.1.2001.1001.102.101.100004" extension="1.0" />
  <patientRole classCode="PAT">
   <id root="ac0cbaae-f63c-4472-a0ee-268ff8f1f661" />
   <!-- Patient.address
   <addr nullFlavor="MSK" />
   <patient>
     <!-- Patient.name -->
      <family>Everyman</family>
<given>Adam</given>
      <given>A.</given>
     </name>
    <administrativeGenderCode code="male" codeSystem="2.16.840.1.113883.4.642.1.2"
codeSystemName="AdministrativeGender" displayName="Male" />
    <!-- Patient.identifier -->
    <cat:asEntityIdentifier classCode="IDENT">
  <ext:id root="1.2.36.1.2001.1003.0.8003608833357361" assigningAuthorityName="IHI" />
  <ext:assigningGeographicArea classCode="PLC">
        <ext:name>National Identifier</ext:name>
      </ext:assigningGeographicArea>
     </ext:asEntityIdentifier>
   </patient>
  </patientRole>
 <!-- author (Patient with mandatory identifier) -->
  cauthor typeCode="AUT">
<templateId root="1.2.36.1.2001.1001.102.101.100003" extension="1.0" />
        Composition.date
  <time value="20170621090015+1000" />
  <assignedAuthor>
   <id root="ac0cbaae-f63c-4472-a0ee-268ff8f1f661" />
<code code="ONESELF" codeSystem="2.16.840.1.113883.5.111" />
   <assignedPerson>
    <!-- Patient.name -->
      <given>Damo</given>
     </name>
     <!-- Patient.identifier -->
    <ext:asEntityIdentifier classCode="IDENT">
      <ext:id root="1.2.36.1.2001.1003.0.8003608833357361" assigningAuthorityName="IHI" />
      <ext:assigningGeographicArea classCode="PLC">
        <ext:name>National Identifier</ext:name>
     </ext:assigningGeographicArea>
</ext:asEntityIdentifier>
   </assignedPerson>
  </assignedAuthor>
 </author>
 <!-- custodian (Organization) -->
  <templateId root="1.2.36.1.2001.1001.102.101.100002" extension="1.0" />
  <assignedCustodian>
   <representedCustodianOrganization>
<id root="987d6a7e-6264-43b0-8666-a14e1d1bff91" />
    <!-- Organization.identifier -->
    <ext:asEntityIdentifier classCode="IDENT">
<ext:id root="1.2.36.1.2001.1007.1.8003640001000036" assigningAuthorityName="PAI-0" />
      <ext:assigningGeographicArea classCode="PLC">
       <ext:name>National Identifier</ext:name>
      </ext:assigningGeographicArea>
     </ext:asEntityIdentifier>
  </representedCustodianOrganization>
</assignedCustodian>
```

```
<component>
  <structuredBody>
   <!-- section (Advance Care Information Section) -->
   <component>
    <section>
     <templateId root="1.2.36.1.2001.1001.102.101.100009" extension="1.0" />
           section.code -
     <code code="101.16973" codeSystem="1.2.36.1.2001.1001.101" displayName="Advance Care Information Section"/>
      <!-- section.title --
     <title>Advance Care Planning</title>
      <!-- section.text -->
      <text mediaType="text/x-hl7-text+xml">
      <paragraph>
        kHtml href="attachment.pdf">Advance Care Plan for Adam</linkHtml>
       </paragraph>
<paragraph>Created on: 03 November 2009</paragraph>
       <paragraph>Created by: Adam Everyman/paragraph>
      </text>
      <entry>
       <!-- DocumentReference -->
       <act classC
        cact classCode="ACT" moodCode="EVN">
<templateId root="1.2.36.1.2001.1001.102.101.100013" extension="1.0"/>
<code code="102.16971" codeSystem="1.2.36.1.2001.1001.101" displayName="Related Document"/>
             - DocumentReference.status -->
        <statusCode code="active"/>
        <!-- DocumentReference.created --:
        <effectiveTime value="200911031235+1000"/>
        <!-- DocumentReference.author (Patient with mandatory identifier) -->
        <author typeCode="AUT">
  <templateId root="1.2.36.1.2001.1001.102.101.100003" extension="1.0" />
  <time value="200911031235+1000"/>
         <assignedAuthor>
          <id root="ac0cbaae-f63c-4472-a0ee-268ff8f1f661" />
<code code="ONESELF" codeSystem="2.16.840.1.113883.5.111"/>
          <assignedPerson>
  <!-- Patient.identifier -->
           <ext:asEntityIdentifier classCode="IDENT">
<ext:id root="1.2.36.1.2001.1003.0.8003608833357361" assigningAuthorityName="IHI" />
             <ext:assigningGeographicArea classCode="PLC">
              <ext:name>National Identifier</ext:name>
             </ext:assigningGeographicArea>
            </ext:asEntityIdentifier>
           </assignedPerson>
        </assignedAuthor>
</author>
        <reference typeCode="REFR">
         <externalDocument class</pre>
                                        de="DOC">
          <!-- DocumentReference.identifier & DocumentReference.msaterIdentifier -->
           <id root="31c45290-2883-11z2-81c1-0800000c9a67"/
          <!-- DocumentReference.type -->
<code code="100.16998" codeSystem="1.2.36.1.2001.1001.101" displayName="Advance Care Planning Document"/>
          <!-- DocumentReference.content.attachment -->
<text integrityCheck="IiZNlyLY4gyewfICeWhFe2NcDDw=" mediaType="application/pdf">
           <reference value="attachment.pdf" />
          </text>
          </externalDocument>
        </reference>
       </act>
      </entry>
    </section>
   </component>
  </structuredBody>
</ClinicalDocument>
```

B.2 Advance Care Planning example 2

This informative appendix provides an example CDA instance that conforms to the requirements of this implementation guide.

Example B.2. Advance Care Plan Level example 2

```
This example is illustrative only. This fragment cannot be treated as clinically valid.
While every effort has been taken to ensure that the examples are consistent with the message specification, where
there are conflicts with the written message specification or schema, the specification or schema will take precedence. -->
<ClinicalDocument classCode="DOCCLIN" moodCode="EVN" xmlns="urn:hl7-org:v3"</pre>
 xmlns:ex="urn:hl7-org/v3-example"
 xmlns:ext="http://ns.electronichealth.net.au/Ci/Cda/Extensions/3.0"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
<typeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040"/>
 <!-- ClinicalDocument templateId -->
 <templateId root="1.2.36.1.2001.1001.102.101.100033" extension="1.0"/>
 <!--Advance Care Planning document model templateId -->
 <templateId root="1.2.36.1.2001.1001.102.101.100016" extension="1.0"/>
<!--CDA Rendering Specification templateId-->
 <templateId root="1.2.36.1.2001.100.226" extension="1.0"/>
<id root="2.25.134045617645909421812767683577428735500"/>
<code code="100.16975" codeSystem="1.2.36.1.2001.1001.101"</pre>
  code code="100.16975" codeSystem="1.2.36.1.2001.1001.101"
codeSystemName="NCTIS Data Components" displayName="Advance Care Planning"/>
 <title>Advance Care Planning Document</title>
 <effectiveTime value="20170621090015+1000"/>
<confidentialityCode nullFlavor="NA"/>
 <languageCode code="en-AU"/>
 <ext:completionCode code="F" codeSystem="1.2.36.1.2001.1001.101.104.20104"</pre>
  codeSystemName="NCTIS Document Status Values" displayName="Final"/>
 <!-- subject (Patient with mandatory identifier) -->
 <recordTarget typeCode="RCT">
  <templateId root="1.2.36.1.2001.1001.102.101.100004" extension="1.0"/>
  <patientRole classCode="PAT">
   <id root="ac0cbaae-f63c-4472-a0ee-268ff8f1f661"/>
   <!-- Patient.address -->
   <addr nullFlavor="MSK"/>
   <patient>
     <!-- Patient.name -->
    <name use="C">
      <given>Adam</given>
      <given qualifier="IN">A.</given>
      <family>Everyman</family>
     <!-- Patient.gender -->
     <administrativeGenderCode code="male" codeSystem="2.16.840.1.113883.4.642.1.2"</pre>
      codeSystemName="AdministrativeGender" displayName="Male"/>
     <!-- Patient.identifier -->
     <ext:asEntityIdentifier classCode="IDENT">
      <ext:id root="1.2.36.1.2001.1003.0.8003608833357361"</pre>
     assigningAuthorityName="IHI"/>
<ext:assigningGeographicArea classCode="PLC"</pre>
       <ext:name>National Identifier</ext:name>
      </ext:assigningGeographicArea>
     </ext:asEntityIdentifier>
   </patient>
   </patientRole>
 </recordTarget>
 <!-- composition-author-role :: author (PractitionerRole with practitioner) -->
  cauthor typeCode="AUT">
<templateId root="1.2.36.1.2001.1001.102.101.100006" extension="1.0"/>
  <!-- Composition.date -->
<time value="20170621090015+1000"/>
  <assignedAuthor>
   <originalText>GP</originalText>
   </code>
        Practitioner.telecom -
   <telecom use="WP" value="mailto:pchalmers@example.albiongp.com.au"/>
<!-- PractitionerRole.practitioner -->
   <assignedPerson>
     <!-- assignedPerson (Base Practitioner) --
    <templateId root="1.2.36.1.2001.1001.102.101.100040" extension="1.0"/>
     <!-- Practitioner.name -->
      <prefix>Dr.</prefix>
      <given>Peter</given>
      <family>Chalmers</family>
     </name>
    <!-- PractitionerRole.identifier or Practitioner.identifier -->
<ext:asEntityIdentifier classCode="IDENT">
<ext:id root="1.2.36.1.2001.1003.0.8003619900015717"
    assigningAuthorityName="HPI-I"/>
      <ext:assigningGeographicArea classCode="PLC">
       <ext:name>National Identifier</ext:name>
      </ext:assigningGeographicArea>
    </ext:asEntityIdentifier>
   </assignedPerson>
   <!-- PractitionerRole.organization -->
```

```
<representedOrganization>
   <!-- representedOrganization (Base Organization) -->
<templateId root="1.2.36.1.2001.1001.102.101.100039" extension="1.0"/>
   <!-- Organization name -->
   <name>Albion GP Clinic</name>
   <!-- Organization.identifier -->
   <ext:asEntityIdentifier classCode="IDENT">
    cext:assigningAuthorityName="HPI-0"/>
<ext:id root="1.2.36.1.2001.1003.0.8003621566684455"
assigningAuthorityName="HPI-0"/>
<ext:assigningGeographicArea classCode="PLC">
     <ext:name>National Identifier</ext:name>
    </ext:assigningGeographicArea>
  </ext:asEntityIdentifier>
</representedOrganization>
 </assignedAuthor>
</author>
<!-- custodian (Organization with mandatory identifier) -->
<custodian>
 <templateId root="1.2.36.1.2001.1001.102.101.100002" extension="1.0"/>
 <assignedCustodian>
 <representedCustodianOrganization>
   <id root="987d6a7e-6264-43b0-8666-a14e1d1bff91"/>
   <!-- Organization.name -->
   <name>Albion GP Clinic</name>
   <!-- Organization.identifier -->
   <ext:asEntityIdentifier classCode="IDENT">
    <ext:id root="1.2.36.1.2001.1003.0.8003621566684455"
assigningAuthorityName="HPI-O"/>
    <ext:assigningGeographicArea classCode="PLC">
     <ext:name>National Identifier</ext:name>
    </ext:assigningGeographicArea>
   </ext:asEntityIdentifier>
  </representedCustodianOrganization>
</assignedCustodian>
</custodian>
<!-- attester (Legal Attester) --> <legalAuthenticator>
<templateId root="1.2.36.1.2001.1001.102.101.100012" extension="1.0"/>
<time value="20170621090015+1000"/>
 <signatureCode code="S"/>
<assignedEntity>
  <!-- attester (Legal Attester) indicating same entity as the author via the same id -->
  <id root="1323691d-27fc-4583-a172-710a787aa204"/>
 </assignedEntity>
</legalAuthenticator:
<structuredBody>
  <!-- section (Advance Care Information Section) -->
  <component>
   <section>
    <templateId root="1.2.36.1.2001.1001.102.101.100009" extension="1.0"/>
    <!-- section.code -->
    <code code="101.16973" codeSystem="1.2.36.1.2001.1001.101"</pre>
     displayName="Advance Care Information Section"/>
     <!-- section.title -->
    <title>Advance Care Planning</title>
    <!-- section.text --
    <text mediaType="text/x-hl7-text+xml" ID="ACP1">
     <paragraph>
       <linkHtml href="attachment.pdf">Advance Care Plan for Adam</linkHtml>
     </paragraph>
     <paragraph>Created on: 03 November 2009</paragraph>
     <paragraph>Created by: Dr. Peter Chalmers</paragraph>
<paragraph>Document status: Final</paragraph>
    </text>
    <entry>
     <!-- DocumentReference -->
     <text><reference value="#ACP1"/></text>
      <!-- DocumentReference.status -->
      <statusCode code="active"/>
      <!-- DocumentReference.created -->
      <effectiveTime value="200911031235+1000"/>
      <!-- DocumentReference.author (PractitionerRole with practitioner) -->
      <author typeCode="AUT">
  <templateId root="1.2.36.1.2001.1001.102.101.100006" extension="1.0"/>
        <time value="200911031235+1000"/>
        <assignedAuthor>
         <id root="1323691d-27fc-4583-a172-710a787aa204"/>
         <!-- PractitionerRole.practitioner -->
         <assignedPerson>
          <!-- assignedPerson (Base Practitioner) -->
<templateId root="1.2.36.1.2001.1001.102.101.100040"</pre>
           extension="1.0"/>
          <!-- PractitionerRole.identifier or Practitioner.identifier -->
          <ext:asEntityIdentifier classCode="IDENT">
           <ext:id root="1.2.36.1.2001.1003.0.8003619900015717"
assigningAuthorityName="HPI-I"/>
           <ext:assigningGeographicArea classCode="PLC">
            <ext:name>National Identifier</ext:name>
           </ext:assigningGeographicArea>
          </ext:asEntityIdentifier>
```

B.3 Advance Care Planning example 3

This informative appendix provides an example CDA instance that conforms to the requirements of this implementation guide.

Example B.3. Advance Care Plan Level example 3

```
This example is illustrative only. This fragment cannot be treated as clinically valid.
While every effort has been taken to ensure that the examples are consistent with the message specification, where
there are conflicts with the written message specification or schema, the specification or schema will take precedence. -->
<ClinicalDocument classCode="DOCCLIN" moodCode="EVN" xmlns="urn:hl7-org:v3"</pre>
 xmlns:ex="urn:h17-org/v3-example"
xmlns:ext="http://ns.electronichealth.net.au/Ci/Cda/Extensions/3.0"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:hl7-org:v3 ../../.library/schema_au_published/CDA-AU-V1_0.xsd">
<typeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040"/>
 <!-- ClinicalDocument templateId -->
<templateId root="1.2.36.1.2001.1001.102.101.100033" extension="1.0"/>
 <!--Advance Care Planning document model templateId -->
<templateId root="1.2.36.1.2001.1001.102.101.100016" extension="1.0"/>
 <!=-CDA Rendering Specification templateId-->
<templateId root="1.2.36.1.2001.1001.100.226" extension="1.0"/>
<id root="1323691d-27fc-4583-a172-710a787aa204"/>
<code code="100.16975" codeSystem="1.2.36.1.2001.1001.101"
codeSystemName="NCTIS Data Components" displayName="Advance Care Planning"/>
 <title>Advance Care Planning Document</title>
<effectiveTime value="20170621090015+1000"/>
 <confidentialityCode nullFlavor="NA"/>
<ext:completionCode code="F" codeSystem="1.2.36.1.2001.1001.101.104.20104"</pre>
   codeSystemName="NCTIS Document Status Values" displayName="Final"/>
 <!-- subject (Patient with mandatory identifier) -->
   <templateId root="1.2.36.1.2001.1001.102.101.100004" extension="1.0"/>
   <patientRole classCode="PAT">
    <id root="6caf1912-969f-4311-b6c0-b4ec7728db64"/>
    <!-- Patient.address -->
    <addr nullFlavor="MSK"/>
    <patient>
     <administrativeGenderCode code="male" codeSystem="2.16.840.1.113883.4.642.1.2"</pre>
       codeSystemName="AdministrativeGender" displayName="Male"/>
     <!-- Patient.identifier -->
     <ext:asEntityIdentifier
      <ext:id root="1.2.36.1.2001.1003.0.8003608833357361"
assigningAuthorityName="IHI"/>
       <ext:assigningGeographicArea classCode="PLC">
       <ext:name>National Identifier</ext:name>
       </ext:assigningGeographicArea>
     </ext:asEntityIdentifier>
    </patient>
    <!-- Patient.managingOrganization -->
    cproviderOrganization classCode="ORG">
      .
<asOrganizationPartOf>
      <wholeOrganization>
                ot="987d6a7e-6264-43b0-8666-a14e1d1bff91"/>
       <name>Devonport Family Medicine Clinic
       </wholeOrganization>
    </asOrganizationPartOf>
</providerOrganization>
   </patientRole>
 </recordTarget>
 <!-- composition-author-role :: author (PractitionerRole with practitioner) -->
 <author typeCode="AUT">
  <templateId root="1.2.36.1.2001.1001.102.101.100006" extension="1.0"/>
  <!-- Composition.date --> <time value="20170621090015+1000"/>
  <assignedAuthor>
<id root="5cc8ab2f-9dd0-4d36-aed6-0e95bba3308f"/>
    <!-- PractitionerRole.code -->
<code code="253111" codeSystem="2.16.840.1.113883.13.62"
displayName="General Practitioner">
     <originalText>GP</originalText>
    <!-- PractitionerRole.telecom -->
    <telecom use="WP" value="mailto:pchalmers@example.albiongp.com.au"/>
    <!-- PractitionerRole.practitioner
    <assignedPerson>
            assignedPerson (Base Practitioner) --
     <templateId root="1.2.36.1.2001.1001.102.101.100040" extension="1.0"/>
     <!-- Practitioner.name --:
       <family>Chalmers</family>
      <given>Peter</given>
       <prefix>Dr.</prefix>
     <!-- PractitionerRole.identifier or Practitioner.identifier -->
     <ext:asEntityIdentifier classCode="IDENT"</pre>
      <ext:id root="1.2.36.1.2001.1003.0.8003619900015717"
assigningAuthorityName="HPI-I"/>
      <ext:assigningGeographicArea classCode="PLC">
<ext:name>National Identifier</ext:name>
      </ext:assigningGeographicArea:
```

```
</ext:asEntityIdentifier>
   <ext:asEntityIdentifier classCode="IDENT">
<ext:id root="1.2.36.174030967.0.2" extension="5544887B"</pre>
    assigningAuthorityName="Medicare Provider number"/>
<ext:code code="PRN" codeSystem="2.16.840.1.113883.12.203"/>
     <ext:assigningGeographicArea classCode="PLC">
     <ext:name>National Identifier</ext:name>
     </ext:assigningGeographicArea>
   </ext:asEntityIdentifier>
  </assignedPerson>
  <!-- PractitionerRole.organization -->
  <representedOrganization>
   <!-- representedOrganization (Base Organization) -->
<templateId root="1.2.36.1.2001.1001.102.101.100039" extension="1.0"/>
   <id root="987d6a7e-6264-43b0-8666-a14e1d1bff91"/>
   <!-- Organization.name
   <name>Devonport Family Medicine Clinic</name>
   <!-- Organization.telecom ->
<telecom use="WP" value="mailto:reception@example.dfmc.com.au"/>
<telecom use="WP" value="fax:0385435557"/>
<telecom use="WP" value="tel:0385435556"/>
         Organization.address -
   <addr use="PST">
     <streetAddressLine>LPO Box 235</streetAddressLine>
    <city>Strahan</city>
     <state>TAS</state>
     <postalCode>7468</postalCode>
   </addr>
   <!-- Organization.identifier -->
   <ext:asEntityIdentifier classCode="IDENT">
    <ext:id root="1.2.36.51824754455"
    assigningAuthorityName="Devonport Family Medicine Clinic"/>
<ext:code code="XX" codeSystem="2.16.840.1.113883.12.203"</pre>
      codeSystemName="Identifier Type (HL7)"/>
   </ext:asEntityIdentifier>
  </representedOrganization>
 </assignedAuthor>
<!-- custodian (Organization with mandatory identifier) -->
 <templateId root="1.2.36.1.2001.1001.102.101.100002" extension="1.0"/>
 <assignedCustodian>
  <representedCustodianOrganization>
<id root="987d6a7e-6264-43b0-8666-a14eld1bff91"/>
   <!-- Organization.name
   <name>Devonport Family Medicine Clinic</name>
    <!-- Organization.identifier -->
   <ext:asEntityIdentifier classCode="IDENT">
<ext:id root="1.2.36.51824754455"</pre>
    assigningAuthorityName="Devonport Family Medicine Clinic"/>
<ext:code code="XX" codeSystem="2.16.840.1.113883.12.203"
codeSystemName="Identifier Type (HL7)"/>
   </ext:asEntityIdentifier>
  </representedCustodianOrganization>
 </assignedCustodian>
</custodian>
<!-- attester (Legal Attester) -->
<legalAuthenticator>
<templateId root="1.2.36.1.2001.1001.102.101.100012" extension="1.0"/>
<time value="20170621090015+1000"/>
 <signatureCode code="S"/>
 <assignedEntity>
  <!-- attester (Legal Attester) indicating same entity as the author via the same id -->
  <id root="5cc8ab2f-9dd0-4d36-aed6-0e95bba3308f"/>
 </assignedEntity>
</legalAuthenticator>
<!-- Patient.generalPractitioner (Base Practitioner)-->
<participant typeCode="PART">
 <functionCode code="PCP"/>
 <associatedEntity classCode="PROV">
<!-- indicating same entity as the author via the same id -->
<id root="5cc8ab2f-9dd0-4d36-aed6-0e95bba3308f"/>
  code code="253111" codeSystem="2.16.840.1.113883.13.62"
codeSystemName="1220.0 - ANZSCO - Australian and New Zealand Standard Classification of Occupations, First Edition, Revision 1"
   displayName="General Medical Practitioner"/>
  <associatedPerson classCode="PSN">
    <!-- Practitioner.identifier -->
   <ext:asEntityIdentifier classCode="IDENT">
<ext:id assigningAuthorityName="HPI-I"</pre>
    root="1.2.36.1.2001.1003.0.8003619900015717"/>
<ext:assigningGeographicArea classCode="PLC">
      <ext:name>National Identifier</ext:name>
    </ext:assigningGeographicArea>
   </ext:asEntityIdentifier>
  </associatedPerson>
 </associatedEntity>
</participant>
<component>
 <structuredBody>
  <!-- section (Advance Care Information Section) -->
   <section>
     <templateId root="1.2.36.1.2001.1001.102.101.100009" extension="1.0"/>
    <!-- section.code --> <code code="101.16973" codeSystem="1.2.36.1.2001.1001.101"
      displayName="Advance Care Information Section"/
         - section.title -
     <title>Advance Care Planning</title>
     <!-- section.text --
```

```
<text mediaType="text/x-hl7-text+xml" ID="ACP1">
 </paragraph>
 <paragraph>Created on: 03 November 2009</paragraph>
 <paragraph>Created by: Dr. Peter Chalmers</paragraph>
 <paragraph>Document status: Final</paragraph>
<entry>
 <!-- DocumentReference -->
 <act classCode="ACT" moodCode="EVN">
<templateId root="1.2.36.1.2001.1001.102.101.100013" extension="1.0"/>
   <code code="102.16971" codeSystem="1.2.36.1.2001.1001.101"
displayName="Related Document"/>
   <text><reference value="#ACP1"/></text>
   <!-- DocumentReference.status -->
   <statusCode code="active"/</pre>
  <!-- DocumentReference.created -->
<effectiveTime value="200911031235+1000"/>
   <!-- DocumentReference.author (PractitionerRole with practitioner) -->
   <author typeCode="AUT">
  <templateId root="1.2.36.1.2001.1001.102.101.100006" extension="1.0"/>
     <time value="200911031235+1000"/>
     <assignedAuthor>
      <id root="5cc8ab2f-9dd0-4d36-aed6-0e95bba3308f"/>
      <!-- PractitionerRole.practitioner
      <assignedPerson>
        <!-- assignedPerson (Base Practitioner)
        <templateId root="1.2.36.1.2001.1001.102.101.100040"
extension="1.0"/>
        <!-- PractitionerRole.identifier or Practitioner.identifier -->
        <ext:asEntityIdentifier classCode="IDENT">
         <ext:id root="1.2.36.1.2001.1003.0.8003619900015717"
assigningAuthorityName="HPI-I"/>
<ext:assigningGeographicArea classCode="PLC">
           <ext:name>National Identifier</ext:name>
          </ext:assigningGeographicArea>
        </ext:asEntityIdentifier>
      </assignedPerson>
     </assignedAuthor>
   </author>
   <!-- DocumentReference.docStatus -->
   <entryRelationship typeCode="COMP">
<observation classCode="OBS" moodCode="EVN">
<code code="103.20104" codeSystem="1.2.36.1.2001.1001.101"</pre>
      displayName="Document Status"/>
<value xsi:type="CD" code="F"</pre>
        codeSystem="1.2.36.1.2001.1001.101.104.20104"
        displayName="Final"/>
     </observation>
   </entryRelationship>
   <reference typeCode="REFR">
     <externalDocument classCode="DOC">
      <!-- DocumentReference.identifier & DocumentReference.msaterIdentifier -->
      <id root="31c45290-2883-11z2-81c1-0800000c9a67"/
       <!-- DocumentReference.type -->
      code code="100.16998" codeSystem="1.2.36.1.2001.1001.101"
displayName="Advance Care Planning Document"/>
      <!-- DocumentReference.content.attachment -->
<text representation="B64" mediaType="application="before" mediaType="applicatio
                                                                ype="application/pdf"
        DQoOMSAwIG9iag08PC9EZWNvZGVQYXJtczw8L0NvbHVtbnMgNS9QcmVkaWN0b3IgMTI+Pi9GaWx0
        ZXIvRmxhdGVEZWNvZGUvSURbPDRDRDkwOkY3MkI2NiU5NkVCMEJDOz1BN0ZGNzIwMiE3PiwvOTkw
        ODAzrkY2QTc0OTQ4OEEwNTdBrEQzrDdFQTM0Nj5dL01uZGV4WzEwIDU4XS9JbmZvIDkgMCBSL0xl
        \label{localmass} bmd0aCAxMzcvUHJ1diAxMjk3NjUvUm9vdCAxMSAwIFIvU216ZSA20C9UeXBlL1hSZWYvV1sxIDMgMV0+PnN0cmVhbQ0KaN5iYmRgeGBgYmBgugciGf1AJMNmEMn2H0RyxIJI9slg9k4wuQNMHgCLZ4DJ
        {\tt NLBIJIjkagGbA2abeIDZmiAyvhFsMkic0fApWFwDRPoWgNmhIFIzHMyWBZFWWWD1YSCS/yhYXAFs}
        yxUOyXoOSP6XmsbABHT/TLBKBsZBRAKDTvOFOIABAIH1FZoNCmVuZHN0cmVhbO11bmRvYmoNc3Rh
         cnR4cmVmDQowDQolJUVPRg0KICAgICAgICAgICAgIA0KNjcgMCBvYmoNPDwvRmlsdGVyL0ZsYXRl
        RGVjb2RlL0kqMTM3L0wqMTixL0xlbmd0aCAxMTcvUyAzOD4+c3RyZWFtDQpo3mJqYJBlYGAqYGBq
        YHz+mgEVMAIxCwNHA7KYLBQzMIQy8DPsEVth4VD84E3jjcNb24X51GQEAisY3OoSTPXFGFgSFZj9
        Mm4wsCo4GM10NTDKPGDWsf4RdqCuAW4846toqDVtYKsYf/JD+IxcAAEGAMGGGRoNCmVuZHN0cmVh
        bQ11bmRvYmoNMTEgMCBvYmoNPDwvTWV0YWRhdGEgMiAwIFIvUGFnZUxhYmVscyA2IDAgUi9QYWdl
        cyA4IDAgUi9UeXBLL0NhdGFsb2c+Pg1lbmRvYmoNMTIgMCBvYmoNPDwvQ29udGVudHNbMTQgMCBS
IDE1IDAgUiAxNiAwIFIgMTcgMCBSIDE4IDAgUiAxOSAwIFIgMjAgMCBSIDIxIDAgUl0vQ3JvcEJv
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aCAxOTA1Pj5zdHJ1YW0NCkiJrFfbbttGEH3XV/CRBKLN3i9AUSC9BEnRNmgroAXSPigybauQRZeU 0+RH+r2d0S5FckmKpNsXy7Y4s9wzZ86cYcnmdsUJk5onNN18s4Ifu9UX1FLx5ebP1cvNhicMnyGcS+UfIfCtw8fSx8P2dFtk80CaE60lTdaMSOpseIzZ82NV8VTu8opkPiPzGQUR2rBLSuEuJ9enf7tZ/bViyT5ZMcOIkgmnijieCEPgrSDeJmW++jU5rr7atF6VUeKUw0w0wd9twrQlGqItsTrZPPhLprvMn/HTZLgRcPlWPLwuF+cc27Lc51X3YpwIRuVsONNtN5xIC7idv5qsAz+/RJlvb71hvJiBe/NEGQIZ mSJcdgHT4cacOKe4v7EgkJUZCvVMmIU0eOGXX1c62VWJR6XaHQOEDxGE4wktJ9xeS4is8nTJj6eA iArpiKJUjwCqL7qw3ZCJ4WPv08cyM0SmRfbH5ruF8PTvwLkiVjZ3iFkUJdeQONfJF5LVwLcauA4t 5E+6C6fdzOesBCL1sgA2MmCTf8wzAeAc4KdOi0f4cFBQ/MN/cTz/53TGrqGnhHxKXWf3WhFGLfNq IGUoiqwtc7zpEh7qEnZ+v6CuKA/G/mNeVnncfU6xoWT98kuDH8srxLkmcCumKEIMyKanMRII0Fb+ TBIIIFCEal+9tFhSesY7wYhZ0IqH7Qlgi6WYgegsqoDxyv6YDwyPLXsPA6pt540nmotq7FwIE3II V3kNV5ASRhlRnZPKCN3xDPAGrpsB8fDcvnt5e78vss5wMA60ak/XNBqEhCsj/PdrTKV7g7BVBSmta+Q/tPLr4pCtBbHQywx7OZY7Z4i1NWiCnlVsRlFA0geQ+jtCitVtDGqhhKoFEzNAPaGsBuYmsm9E 9QMx3x5PZRGNsUsCuFsC3QZDmDn8T+u9+6eiPrdP9a/9FF0J87POamuwi8FTuGWmAvqBQF21AxXgXZXO57Yq5w4/ujkQE9k2Tr1mZWrarblAk/T39BwfoD+f7aEXlDX2KxD4/mBIeHmu4d0k4G092CHr ATA4CwG6jWE0S9pd4XU16BQc0EHuQxu5gUjB8IhuJDoHE2Zala3NwNBiBCLtIoE7d2F6m29PT2W/ BMLJwYnV4m7ARW1k4/OGDNBAK4cswwGwnc0qQAnxvYQiQr7L+rOXKm0WAeOR3j4+Hj7vj9laEpPe RXCDe5BugqIQaKUSyRrtsnZ19pD+ocjW0L/pzdNhWz4je+ud1w27d0WsL5RAoTWyCoyAImaWMFqK $\label{eq:wqgfJNQ2AvMwJjDQ0nrMCA43B0w4zMB1usQ} $$ TfQF6AhvYi71fp/ebz2Q/Y4QUi/qCK6CJh1i+wCznppl3SXqxSUbahoF/T3WM8ODSqOPM1i/C2T5lJSAkLaC1jW3O9PnaD4bO8OeumYsC2+OitsojxVm2D4bO9OeumYsC2+OitsojxVm2D4bO9$ Uatr6Wu4K46nPANTbdJP0WivAYNWF8sQQ1GCFUW0RuR+CjGKiEVBx+iSStRTZfJ+9ZYGLX6XCShY 16KcULFMm+oxsD9Wpz0CxgPv+4AxjRK5FDBwH0KPm8a6t8YUOYqfvI+uV7VPmYbi7zNQkrQCqE6w 1rLw9xF+ugEJZ1zPF8mL9KbVaaQnFyJmwbPpHmLHEZGU4IAWEVijBEsnOly8nSYwt60o5KDfSatTPBc5rTt6Hnz/43brQtVBugHztPrc024r5Ni6FhYXJD+D/WANxNOQPDRIMArltoT+00iXQupmWVGu 3XPpi96yUhupmUsiDPMt+oQ0vgYnXMNgnOOipLJYuee4qLNJ15rh8oAuK15frrgojuc0oc0M3J/u $\label{local-condition} ezbKqUVKFexY8V/tmKormmdwU+heUAoOwgQmCfRhUPuugjnUyRK1r8HB82I31skS64p5Zd9MNfwcNj4CwoG4zSkfomqNR/vN4BK+bhSt+NQDGXtsLsjpP1EHSGf5tQ5oOQHuReHDtsrjd7DOLbJMhgfL$ FKmz4uD5AuhgacSsigJIMoa6mg01mE3gr4QP1vK/ryKYNK3dzkJ8FRqoJQ4iff3m7c89fEEjF+Hb lu9+z8DV+TK/AO5NwpOsNf1+m5pPHGxvE9ToxA/fv+hNFW6mFaemInYDVV4pvvv1Hc4Vkf6YrRnI eyzKQgoxT5SvYXJVWWGB4q17pm9GtEQ4CQ8K8D6DBlxhKFwDog2udXjAuyXchn2gCUXgdJDYfR58 OOylNWyitltU2MFZ1pw2aLdelbuIcIYjLP7qcOnZK2nntT3f7mfPuoC3BRFtScJN3J1c6X5nDl/P K1++rfaHep8SF4oZOo1Vh7serKded2qFY0YYixzkFLzOTG8KMMW3zcdYqM8VUWgk5rS+ggjgSJN4 O21LZRwT+VGwZVTOFEWuvRkuylqzmLVjtvHKSvA+vck/5qewcMSmRewpsDtriKOjsyCyHOdPdOPH CZSgM7HUcAalXXXsW26q2KLdh4fhur8ryuKp6qbD+wzahZ4iCqmRWM9RRIEjtblca5WJjqACkz/H $\label{eq:coaclpcdsb915bxntA-1+ssitchJQwwp/Niw97ALph8K8AAylDV1A0KZW5kc3RyZWFtDWVuZG9iag0xOCAwIG9iag08PC9GaWx0ZXIvRmxhdGVEZWNvZGUvTGVuZ3RoIDE5MTM+PnN0cmVhbQ0KSImkRyDGVEZWNvZGUvTGVUZ3RoIDE5MTM+PnN0cmVhbQ0KSImkRyDGVEZWNvZGUvTGVUZ3RoIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM+PnN0cmVhbQ0KSImkRyDGVUZ3ROIDE5MTM$ V8tu68gR3esruKSAq77sd3cQBJg8gItggGQAIVncZKEr07Zm9HBEOU5+YxbzvTnVTYpUkxLJycY2 YHZ1161Tp06t/7z4vF7zjGfr54VqrnAmK7L1Hxf4sV38tiqK+bv1j/SNiN8wIZSOnzD8V9Nn+a5a xo/qQMw1xwfFFSH64ni/Gm9+NeCZ7ts1YRjvmSykIy7TFv6ySwTLjuXi79nx8Xv1wteMK893VZk 9LfLhNNMGpwyjCPuIb4h/6hj/5BEF84ymynB7KTgwjJlMuELZ1Qb/HQNPnxKSiZc5xRyRi508lwm 2Dk9EzsT4jzvyv1TUgcBwJovpwUTMgTbxFetJHPWiGwlmOTG3xTra37cLVea2fz4svznussjzqy2 avK1+SZBQD1gE/41/14V31vtDm/7Qe4II5gwM7gjmKJTmgmUqC1wOVJgqq7y4FA8RPWNnD4fPt2mx5kq+HiXed9WODJ1uzn21gnn55RX8tgKp/MwWMowp2aAxZkWN31HsH4aA8szkEgUjkFuI1rSRuJ925dpknZeP/BIidfLYZ9Gcl7JWaG6LdpBy0oSClFo5nF0kMxMQQsqpjpZR6ze7sgStw4ymgn0vMk46Kg60fFgUyclmPcoQrhHBliFDlJGxaFrPv+hMtm2yuJbqu2xvnjbLdLDgBJveBRvBaiUiqJQVssV 6JNXjSboKldViPoA/CHdDILJ0Y7+2o4vofFjaTbp5IFezdK70kyvs4pihoK13f7le5tG0qaYRbq6 R6vLYIty6Jmfo2egagpgyPge7ZRlWmWYV/g5ZRwa+oTrAqrdRr+MjcOCFapzijUO4Lzb9LpWeDtr htWleK9KloYyxrtZs7Vm9XfPy5VhOr+Ugdb9qsggApOrAtQMndKsMN2qbMdw46QD3XPOSBsfuQuP bSCyz8bdjife5CVxkdTNOGldg8UcjPb83oB6T6t5PyR8tXMPQ16NQb21fKDZdseX7MstdhJcFHVuXFHQNLf+7VL6gIfrrhtFuOL7JIX7g85BXjKDPFQdA/9pHi7agKfzy+fn112wbzQJYS101wHm/1gm $\label{lower_lower} $$ JQF51PMdP5Lc1ATVae58L1r1BBpKtQmGml1n1NT1BUQIoMs4ASB/zwFQNDXWMW86v1Ept2eU58gZ2hhawUx33/uLV145CwXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz114q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz144Q0nmLGHAU18D4CWXXjvUv5WJC5ck7wY54BTM6hQV1KpAu96kHczDyBwB1BAFoz144Q0nmLGHAU18D4CWXXjvUv5WJC5ck7wW54BTM6hQV1KpAu96kHczDyBwB1BAFoz144Q0nmLGHAU18D4CWXXjvUv5WJC5ck7wW54BTW6hQV1KpAu96kHczDyBwB1BAFoz144Q0nmLGHAU18D4CWXXjvUv5WJC5ck7wW54BWAU18D4CWXXjvUv5WJC5ck7wW54BWAU18D4CWXXjvUv5WJC5ck7wW54BWAU18D4CWXXjvUv5WJC5ck7wW54BWAU18D4CWXXjvUv5WJC5ck7wW54BWAU18D4CWXXjvUv5WJC5ck7wW54BWAU18D4CWXXjvUv5WJC5ck7wW54WW54WJC5ck7wW54WJc5ck7wW54WJC5ck7wW54WJC5ck7wW54WJC5ck7wW54WJC5ck7wW54WJC5ck7wW54WJC5ck7wW54WJC5ck7wW54WJC5ck7wW54WJc5ck7wW54WJc5ck7wW54WJc5ck7wW54WJc5ch7wW54WJc5ch7w7w54WJc5ch7w7w54WJc5ch7w7w54WJc5ch7w7w54WJc5$ NfCsOpPysqMhJPOX10tvK3T+103f59NyBdOcb9+rJOb9Bbcjh5FXwJbfW20eE6sgv26kYkXwKtfB $\label{localine} OKGpPalje5ry4jGnn+tk4ZOP5fGSZoXXST+LnYWpN8R9cE8ryJfGqrOiXRMPuapD4q06QUaLoV18\\OO2OCoE0ivzUK4fUEx7eRP2ab/e7IwiDAsH6JM4qlo0Hpk6lG1IJElDDsTuFWm3GGyG4aUvigQNE$ 5ei/L6mYWeFG9pf/R027UhPuP5y+7fzlKjWODyvqsIV7CmRQzBopIhloTesw5mv+fgn4S9gysAZ8 rFLfKJj1E7Syq2+6XqqeeruQHFyFOhKIGutMQ5gkjXWm5zWrhB/BL40lSYqkWW94pbkhokAUTF9m H/c0WQMNVyAjy45z1ABS3R69T0Kv+d0GVNPn56fqNz34teYjC+QKNeLgDX5Ly02jyTWRT+noM7PWqTjcsV4c3ogpIt+XB/pD5711KECrYGIA5+SWhXuCblJeliWLSpXCqh4NftQQqw1M73Un4jH38j+b w9u+TFoZrs34EUhvMXAyMvrfy4HRojQ81x6ikdUpRlvRlFMGk8WZVPqBPWBLe4oqEzcAWvZ6nqQQ xaBa9R4PxYTngN9yc+eipgIrRZsUNUIlqxHagleint7P27RUILYYF7y7qqt8o9njI7S733UXAg/5 bGDigaTTSO1Um2MscTl5PQWn4RgU7ubuen5yp15eY6OWVdkTE6H1LC0X0T9X11rNu1KtURw80tC2 $KSyp2jTDSu16mlpnTt+yE4dA96\bar{1}aQ16NmgR\bar{f}ctMG/zLWWoZ+taeIkZEN6/VfP6UzzKp5+qnrqnx3WWLHy0+Hpc77MlZPbNdHgDyejC6ozjXJ/C/DkEuvwFkVTO/ABQ90GIXFPd5SCeiClzkSjsnYH11dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH11dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClzkSjsnYH1dABQ90GIXFPd5SCeiClxkSjsnYH1dABQ90GIXFPd5SCeiClxkSjsnYH1dABQ90GIXFPd5SCeiClxkSjsnYH1dABQ90GIXFPd5SCeiClxkSjsnYH1dABQ90GIXFPd5SCeiClxkSjsnYH1dABQ90GIXFPd5SCeiClxkSjsnYH1dABQ90GIXFPd5SCeiClxkSjsnYH1dABQ90GIXFPd5SCeiClxkSjsnYH1dABQ90GIXFPd5SCeiClxkSjsnYhidABQ90GIXFPd5SCeiClxkSis$ +xFj51Juo/2/vJ/Lv1U2ZoYtI0LHRW6T2juHLn9sTUBZQB/xATLD+Nwvg0JMqi4+H3cKYB0VVwqq 17wKSFIN6TgNVLohFZwHR8kwtycJpyjK5+py0jU+TgyLcv4pXSv048Wxq1mx0b79Nwnhnz7eZfm3 obks4QLB9bhBTBEPEXA3mGsBvbcx2YDXVO33pBrRJpTnKhUNoYSb0t9SmV+7pgraZKTyzZr6PH0e G5pg7VGgfizL6XzY7NOJLL24X5rsfwIMAJZ714wNCmVuZHN0cmVhb011bmRvYmoNMTkgMCBvYmoN PDwvRmlsdGVyL0ZsYXRlRGVjb2RlL0xlbmd0aCAxODI1Pj5zdHJlYW0NCkiJrFfbjuNEEH3PV1ji $\tt xZF2evt+kRDSclktCAmxiuBh4MEknkmYJB7szA58Bz9MlduJ7bYTtle8TCJNquw6darOKZasHhaEc6kSmqy+XRBKmUlW68V9esiel3cyfV4yotLd8vfVD4vvVou/FizZJQtuFXGJoIIwmyhOBE+YIMImghapharamatalamata$ Zb74NTkuv14tGCVOOQZ5aYLfbYJBAoIOYTxZHRYUH5S+Lld/YuafMejtasUShi81Eu7gaTqM/5JSKr6CFBDKfWi/HviKjzkVS/+jJj+xhjY/istDbZlnmxO3+7yfixPjOB9LliImJCXaniHjRA4Aax88 rPOSfa49PXVhG8NaE4qYQZzEgMn6uKzryzabfBOWp/R4eblczvmf3CGJrmCu4yFPsyBYWgCu/tdE YLXsIe+5yjUnXCfKIPwxXAVSa4hShNf1AoR5NF0tIdb2gifhZ66G7KHMDv1rUT71i5dQvZO3GRZR 522K8X65D5dy+w+Qmlj5GQ/glhEJkEpHjG2e8TTNYtWLmMRR+KWyO237CDJiWQSJuwOv/CKETHcA S5pXeb0Fu4PBlTJRXf1c0ISwA9DyK42h8JcnShI9sy+iXhXUwnzWD3gOiH4j1GJZbeh590/TMq+W d4ZoeFsi0uMpO+2KY4CfJIYJF4MfA1Y72P0QMW9xYnGwOBkQ252Jnc0pD57aDUZeOF/hcQP6SGya lRsyIIbWWswhmlfd9F0VLD1n5CyVEj5P8RBuXmFGidrmAY4zbUVyB1NKpaw3aRlkEYrKWyt4IAF+ejQxaTg7DNarmDWPzAvwc17uioFCXcO7I8DQU6A5k4YoCXM1czkyYoAJisIirklUjA8hExwV+vO2 $o0 \\ buk0J1Q9QinqgGrVE3GLngVbg6BV00IG7Rao6E985gv3vK9/+EwF0nRyf4ajJF0N02LMZk+iZ+o6JFeB817ypfrrQHDJTmiXBk2P/ry4M6cEDd7JPmy9S97MSleThLVsLKnAGcb+ZLtTs+hj1gi11L$ eJCq9bHB8cfQUd1I6bBxt1KeMWpW9OsiNcn7D9/3WQZLh+imMgFc0IPKRp4NJpp2y6lfntaP+Bg7

okJKxFFDLtkkeewmmut208wQTTuP+d9LqAvYGa5a45SdP/H36WN+R08jYHvfwd9ynCfaQBJLTMwN iNOAk6KNJE62A1XdHighFY55G4X3ih8IdBWB00PX0D1Z3cvHe0b+JtvTms3SJ+/gf8nLaheOzt02 CXHiDNsfgZOT+BHiVEzhJMAva+WQao0INIZggBLVfFZ5qrE9u8NSEQkeUYGq7+vv+RL98QE4whqd H3JEgZO38XvdaXRebSW+/GO41c/ZBSPsmr0eV3OcRbCT1LbZ91Pgws91J6pVs3wzQJe7Wf5PNzP878e1wVsDEFUwFQIQLV6WGKYPTsB0fQXcmeU7Cw8f1J9Plc/hBEk0TPrZ6nPvyLJ9ODiMTZjNfvFW +OKZ4XJWDLoZ7C81rJwlis3+ymqLLLD7jiOnIL5CyrlGuYoADo4xUFplDJ4hF+A2000Jd9klijQC nOafduu8ehPKuVHjR9HVQ9W3YbOvXjbB4mmqhDGC0mTtfeLKBPui4OYSneE7TJVZe9A2CsvOdb6s t+F8SBPhQYf30aEocxLiJcWk9/c4SBBfqJ0xouddkQIMo8R40dTW2USTul9LVyc0tONCRN1UCIIX $\label{eq:tshift} $$ qt/SbfYpD1Hgep7qNdfBa1E0xQqEqsEK^9EoNsRpf2L0yPWeepkcDJk/CaHB5uVuYZ02222d/7Ad1 amPimXM5RNNTEfpvrWaZBK/uT7v161hJWCRixgZ2NVqduk08gvR452iMjtM38N8QA8ybsd4VuuEggrafereepkga48ybsd4VuuEggrafereepkga48ybsd4VuuEggrafereepkga48ybsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4VuuEggrafereepkg48ybbsd4$ KNA1UE2lb5GlC1gjDlWIu51FU+bT7MI1OTfP2QcNzjDL4nngXXqn+TAkjHe6w+JmBUxTi3RHP4Kmcz9TNtbV1B+SO/w9Js6mWq7r6bsEXIa13FThwuaGzlrYZ1HKBsZTcjstb+etd9euvXU4wU7xPgWE 4UEiQc9L8cL/AGOAAlTKRbpyUEaLQQKlDiH+aRpi4EQbgMj4ct69nLYD6eecTx9qXZQb/3lakxBmxcYX3AACPDWAw2rsgLutbHBYQrTBChGL13hNBFuv06FYifaV7EMzCafrrDv1/9o7ft8f8qoKiGOB Awlo4CRklHGESqXsFOy36+R8+v5YhkummU/p19hp4KhgF80r0Gfa5J/yffEc1Kgpen20AgzfHs1P n AfQn den 1808WZER7VH19f/4GDLB6V1XAPe Uegh3PryfjeBU13jpZgOV5fgaaeZ8znkL3Wqr9lCtrwiBoKLOY4mLvG7hToXV1+vDafq6NZ0gqFr55bLNQ/huHrfJfwIMANsX0QANCmVuZHN0cmVhbQ1lq1bU12HN0cmVhbQ1bU12HN0cmVhbQ1bU1bmRvYmoNMjAgMCBvYmoNPDwvRmlsdGVyL0ZsYXRlRGVjb2RlL0xlbmd0aCAxODIzPj5zdHJlYW0N CkiJrFfLjttGELzrK3ikAGs8j54XEARI7BziWwIBOQQ5cCXtmrEsOaLW8P5HviPfmO4ZkqKGlEga u5ddw+wmu7q6ulpk68cFk9L7jGfr9wvGuVDZerPIvxansngo9+V5uf578ct68c9CZGW2UNoxnSmu mHAZCGZNJhRTLjvtFn9kh8XP64XqzGsvMCPP6G+XKW/pEcUNEzJbf17w8I6XOvVvN6JA4auk58wA BdHHUdyf+ZfdcqWZyDflY7kpzuXx8Gb51/rD4u16LTJBNQHz3plYVHjZD5xz9eN1KZifu0wayaTB b2S+XwtmlDHj0PdJpqzGaybDp31e5I/dku4Ha2blVTDWp2wA5niiNJdqmHNCDxVzeUOniStM1CC1 +3ZGrAyT+WFbHgJIHQAcAgANAMJijonNFHD15bGdT23tCcBgmINMW6LMhPzKMYfIgGfWdfPvxugC TMFV3IUxAQaizGG5AmbzCjlTJZxRzFkjR2EG3c4Kl+HDnqvlILFmlu19oF0v7nJ8TBTixRE2U1ct XYgsqpRHdnAmBuvLiyQYHNYR/us+/y4i81js99dJBJPg1CyMQwfzh2LzKU318GfSiAtkOA73cCfu TmmtCsh1pzjiN9vRDRmHS0eWfigCPWX+vBRM5cXppUdRAXJ6C4kJsROSi0GO3kVmmKPgroqLHIUbsy/AMj1jBlBScUMIzeklbfbjGOSWeehFPSb8xfVj7vG3SzqIDTmfSpINjbOwkgzyfdIPwYyaoMyd zMLWkrFL2QxikMzDs51u5e9D2+uwv1vcxoGWjHaKZty0CtuI4NPHtCIt7SxsL1w17DoXLijn9GW9CRP6EzKGrNSkmL9uEMRAnCbMKzLsnsJ3XTfh199TeVTW3hcU4Jx2pUX/4zKCB6dYeGYSQRENBgqf UTpCqCLmnCmMd7UTevuuMtmmyiLM1eawyH9PPMTtZMAF7ex72bBaiLD+ly2HSjHOUve/Qxu9YThQ BguC2tQ91ZN3muqC6Bt0kqLVwzw4u5QIgmMb5+wPH3JV5+KwLeYjMPDN2iD9rz76uuYkO7o8P3EY sZfGAmnZVOkjBqBYpVEJajiJepL05SoN5F5O3fl10w7bng6oWRtfBfHN373/KU1klR4UlH5LsUca MTUkh/NIjS4Ywz1CFhTxMJ3KYZNeQ1tpxDWC6wNHNH8128TmeFW9sN5q58602JmmOiXIgYsoxnOK cwwoHGhZUHW76dWh4MhOKPUpOrPqX5b2iZvGZ9Jjvq1moPOguxQKCdcfd+12xN3L1fRd0g5jgxtC 5Vrc8E7Q0wYdH7mJlrCYWZxF4Vjjw7mLBCir84nOMCBN+7rrtV4JOWtE1lBfTsdhQROalHm6oEHobfPdUUIebuiZRqmZLpakajgO2lqCpk2+TVfcbd7hhnNp/KgWNWff5viZJs7n+AvBfz6EAXT5pggt 6CE3rzjQmi7VtLjzDeSAVj/mxeyTkD00lcCHc6JN/ml8H4DpRLVmNi8PT71bTJpZuxRMTefDEhD0 8xJ5hl0B0pCfHotN5PWqNsUr+hIMbrLnyf2Gow/Q7BZlZfLiilu/GDZc4qdz7wr0MGt2ZNxT293X 3T4dH0v9BCSBQgiZkRNJgBsLkAQSuifR8RYN0ETLOScXgkyihfbgxgDdpkETRCyIEBZfzrttKq7K 8nlhpYkH1vGUNkM4J2a5s9iM/bCQzYSKBBvdVgLVZly1MS9ITy+JWNVW5hvKdlog+vdZUN1zRW7W8NUzsEfeDoMlDTJwrnhd6r5vY5UHJmeQ1tJNRL9ERxmLsVagCZKdqFbJ86fEEKDV8r0I9np9qG3P 9rh5HuyDsi6AJImL03QeP0A5Ud9wEapRr4FTazpRVKKLHawSqCzAq1G2VtoVPWbu+zroooqreF/G 7etxIgeXrwJDfZdANJ4GnMIg39izCYOONucS0Pqz/HzYVVUqikKLQdj63420Fbdcw9ixgTsGN13d xPxlvOum8/y4vEINPh4gFpF/rlD8r80nOmMtZw1AvGryh5d0JN3wdTZs0QO5VsAMlUhegWOB9Qsu NqP5IvJN8M7oNIqKTMz19wMTyk9/7SaZWXBo+KRDB5c52rPTtqzITKKbM0Glbm56aWZuekuPSIPr iOcnkT9NN8qSbt1u8LidU6+libWnKrZoL8pBVZyJBWhJ6HbLibp4uD8hyqNtQwnxzLoY9qoGWEft $\label{eq:p3_c9xybcf} P3/c9XyBcfY7tn1Vf06dusK0nbo4N15Jn63I75hmb0qbZ1twX/ZLegT3LQ6WQ1XpJTyY6TNzsWnH m93lmrR1zsVJSs9x+My4YxbIHW8o1v4xYY58WL3IHX/FHRhTV3TyA2FvEp2TGous75ZpuJWJJWTa$ TNCs7jlbK+LDbl0EixbyXdJUxaRCZZ6ysARY0gqgPThvX2Gs5nSwXsvexRvEuU5A9r8AawAhq9d1 DQplbmRzdHJ1YW0NZW5kb2JqDTixIDAgb2JqDTw8L0ZpbHRlci9GbGF0ZUR1Y29kZS9MZW5ndGgg MTgxMD4+c3RyZWFtDQpIiaRXy47bRhC86yuYGwVYE857BjByCOzACXJJIiAHJwday91VrJU2kvz6 +1TPMCI1pKShffH6wG5Nd1dXV72sqkr+sPxn9v1yK0peL09nTAili6pYvpqxquKuWK5m5cfm0I9f 8fgVZ8IZEz+r6JOXo5m8P2USKmQ6PjZpJmmkuJmp/yYbMh2eQ6bXy9m/M16si5kSFfOm4MoyrQpp mHIF10y6Yt/M/iy2sx+XM45Pt0fIVRX0f1coLUOUruj75VN8RL1qc/92yq4tU6owzoa8mmGRld3Qh8Yju+iy70/ZL0R5elMXhaorESLvDuftY15oOal7JuS539dPzadd0kErmDb/16gEq0xGjZoL5iVG PblKx/AayxXzqq2SS4p8Wz7vd/OFZb68+7A6zv9e/tIrWVJBdkrN1Y5ZN+vtfKGZKJuQsld4O1wr CvyP5+CGqhau9/pY8+ESbiRnHKjUTOeiUqI3UrGqh8rmdked6EXR3sn4rt2H/apJwCOBzSq/k4ve gFb1f0GZKbfJcDhTEuW0p0x122vCV9sS7s0/SUu6B4y1XjKjCXCnQnudSfq0TQVRjU/12o8oreiP4Y6Z8Avv+r2/GmkqZ1UX2QdgQ/gz5dNh0DYv7CQWFJGZ64SYmeMAWG6esk6ilbMtm9wmEtUSScIh GX0fGy16JrqeRbjXF4aqsXSuAN3rPA7Wz0EnrKWxnJIfb30wVr0oKtmHyPVue3iRXjEvxaR7WPGQ 6/Wb39NMRsvzBZJWJJkkF7yd4Lvz9utKMevaDnnmhps13nxNBN4V22v9he5YuhTKI31g/DK9S9Ir kYmkuB0lyPk8hdVafwuUucuFcqsoltuHTSJPBJPaj1JkD/JGMYxM4fyh0xASYhrVaA451e/l3QXc $\label{lower} Ih2TPwzUutJV/n1Bpig/mnr1+FWM2c8Ut3R3HD04Vzt3YedMr+h4FB6zaE96S5r1bBXGNoGbaRW2PNR8Xj3WgQwXoB/871La7tuPl1paYo1PFLTsUEoYeQO4yKe9s8XCMCeh8fteD4k/NnuSKao8NElu$ IF1Wf1JJLZC2d+n4tcz3LWVq9ZwhgyQrSdMT1qRG3syNQ1TwZLQjHy8QrYADst1YIjqCnhXgf6OGrader for the control of the con7Dq+cbL3PYE7yoFDKueslNMg9E397uuTqHVWu6fn0X0TJpC3Q59yOiTwnTBg3SrekLhu29t+Bmw9 jHtIb701ubJVtlL8pzc/z2Ejyt8H6+OcHDUwlzLq1hLtG+yjIacVUmJ3Le457W7Y2fjrshXN9VPz abd/f16HYproJHsrxplQVBpuYgJ6wSIIgnU0WeCFvanOAlLdpoU2mdMagkI/dvsUrtzdPjMDuMKX btbbNdgLkgD4pKueMpiltwzSguAGRllI5rkw36ou27v1al/fDy5E5c000o34+eNYb0dnj4tDxDjF doEKORbMny3YJQXKIY2uKB9bwAqHJla9K7u6vfYgxi6K5tsu2fp+varnCwfscyZLGjV2bjfHrFS5fZFMwzKt5agYvdjgyMNvfh1v77Ty6eDoQfU27a3m4A1RGBwdRabN5rhaDSgYXBAlusz7633V3JAh TKPep9DWSiXQ7vnL9q14oyTXMs3nCPJJBi7Gq840Xn8w9rALyNyPt+Wnx/1CARHrzVDCYLdH0XZY JCrkdOlGbtz10iXN0EiAP2rxJ1eLaw49asFrXXDvqB/Wmy8pTlo/TmfDarimZqIaOc09EknAHxi0 rQzV1PnVGAZ5eYpcUC2iJeojdhd7RLuL8eKIpHOqcNWzKtPAB9YRmmoqHivoYDRbw9xaNbU2GC57 FkzVRdV0aAbyS/G8MS1sJyrAgoxo2usPio7GS+oD1XKXX4slmu5Cu8tcf/nur/lASppMzLWmDC9z U0fD6Sk90/s4pRiuzu1s1RqrRGWADV0exKQnkUQjn7g7Fei85xfPFe8tfGkxajUfmkM6EWnGz9yw kGiZ8BtqKgtwgvmoecqgAboXplCCV6CBcrf5uN4+pKpIKXvDq0BcGydsVNf4iZb9W24B6Qd0+bw+fmFDC3taRRJn/vQLo7+iyDDgr+QQaq1mjVPYr5oDS+fgBbcxd+A6cy051sLj6ecGoaX6x/o4GLEy t3QrzpXlQbdaYdz5cw/1fUPdSFqND/W1ZgwAlCpMqSYf/yoA74rUzNgIL8G4/RxUYNTE9X7AuVLb 2vZi4ORG3YiXOmu/WoUoBL146n7BNnVisacTL4ijwAxdwG1xFKr7tN5shsdJXCqv+E+AAOCeM8Y+ DQplbmRzdHJlYW0NZW5kb2JqDTIyIDAgb2JqDTw8L0FsdGVybmF0ZS9EZXZpY2VSR0IvRmlsdGVy L0ZsYXR1RGVjb2R1L0x1bmd0aCAyNTk3L04gMz4+c3RyZWFtDQpo3pyWd1RU1xaHz713eqHNMNIZ epMuMID0LiAdBFEYZgYYygDDDE1siKhARBERAUWQoIABo6FIrIhiISioYA9IEFBiMIqoqGRG1kp8 eXnv5eX3x73f2mfvc/fze5+1LgAkTx8uLwWWAiCZJ+AHejjTV4VH0LH9AAZ4gAGmADBZ6am+Qe7B QCQvNxd6usgJ/IveDAFI/L51601Pp4P/T9KsVL4AAMhfxOZsTjpLxPkiTsoUpIrtMyKmxiSKGUaJ mS9KUMRyYo5b5KWffRbZUczsZB5bxOKcU9nJbDH3iHh7hpAjYsRHxAUZXE6miG+LWDNJmMwV8VtxbbKHmQ4Aiis2CziseBGbiJjEDw50EfFyAHCkuC845gsWcLIE4kO5pKRm871x8QK6LkuPbmptzaB7 cjkTOAKBOT+Tlcjks+kuKcmpTf42AItn/iwZcW3poiJbmlpbWhqaGZ1+Uaj/uvg3Je7tIrOK+NwziNb3h+2v/FLqAGDMimqz6w9bzH4AOrYCIHf/D5vmIQAkRX1rv/HFeWjieYkXCFJtjI0zMzONuByW kbigv+t/OvwNffE9I/F2v5eH7sqJZQqTBHRx3VgpSS1CPj09lcni0A3/PMT/OPCv81gayIn18Dk8 UUSoaMq4vDhRu3lsroCbwqNzef+pif8w7E9anGuRKPWfADXKCEjdoALk5z6AohABEn1Q3PXf++aDDwXimxemOrE4958F/fuucIn4kc6N+xznEhhMZwn5GYtr4msJ0IAAJAEVyAMVoAF0gSEwA1bAFjgC A9A9aBSagn6F3sMITIKpsDKsDRvDDNgJ9oaD4TVwHJwG58D58E64Aq6Dj8Ht8AX4OnwHHoGfw7MI QIgIDVFDDBEG4oL4IRFILMJHNiCFSDlSh7QgXUgvcgsZQaaRdygMioKiowxRtihPVAiKhUpDbUAV

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TPUJdYVbhaMZ9hlVGW8zQzNPZkln8bL6svWzd2RP5LjnfL0otY61rjtXLXdz7uh6p/WlG6ANMRu6 N2pszN84vslj09HNhM27m3/IM8krzXu97mxLV75y/qb8sa0eW5sLJAr4ReDbbLfVbEdt527v32G+ Y/+OT4XswmtFJkXlRR+KWcXXvjL9quKrhZ2xO/tLLEsO7sLs4u0a2u2w+2ipdGl06dge3z3tZfSy wrLXe6P2XilfVl6zj7BPuG+kwqeic7/m/l37PlTGV96pcq5qrVaq3lE9d4B9YPCg48GWGuWaopr3 $\verb|h7iH7tZ61LbXadeVH8Yczjj8tD60vvdrxteNDQoNRQ0fj/C0jBwNPNrTaNXY2KTUVNIMNwubp45F| \\$ Hrv5jes3nS2GLbWttNai4+C48Pizb6O/HTrhfaL7JONky3da31W3UdoK26H27PaZjviOkc7wzoFT K051d912tX1v9P2R02qnq87Inik5Szibf3bhXM652f0p56cvxF0Y647qfnBx1cXbPQE9/Ze8L125 7H75Yq9T77krdld0X7W5euoa41rHdcvr7X0WfW0/WPzQlm/Z337D6kbnTeubXQPLB84O0gxeu0V6 6/Jtr9vX76y8MzAUMnR3OHJ45C777uS9pHsv72fcn3+w6SH6YeEjqUf1j5Ue1/2o92PriOXImVHX 0b4nQU8ejLHGnv+U/tOH8fyn5KflE6oTjZNmk6en3KduPlv9bPx56vP56YKfpX+ufqH74rtfHH/p mlklM/6S/3Lhl+JX8q+OvF72unvWf/bxm+Q383OFb+XfHn3HeNf7Puz9xHzmB+yHio96H7s+eX96 $\label{logicond} ZW5kb2JqDT101DAgb2JqDTw8L0ZpbHrlci9GbGF0ZURlY29kZS9MZW5ndGggMTMyOTgvTGVuZ3RoMSA0NTU4ND4+c3RyZWFtDQpo3rRbB3xVRfY+t70XQot0CMILj9AVREQEhBCSUEJJCCUJLYWE01s0$ QTECIgSwYFBREaKuBQFfYotrQxcVxcK6Yll37QUVFAvuAsm7/2/KeXl5FNnf7j/w5XxzptyZuXNn zpmZkEFEdamYLOoxOqN7zxP/fOoDaJ4DcvKXLPIF7t73LpHRmshpXTh/+pzffx9Zj8jTh6hOq+mz ry5c+bVnCdF8xBvrigpypx35pOfnROUfIn/vIijq725UQNRwLMLti+YsWjamxzNfIryMqH/p7Hn5 udRskE204AGE75mTu2x+3JAO8chfifS+ublzCuYHG79FtCeByFo6f2HB/FmPmUGiEahD+xiy7K7G LeRQ1LPVuRQ1aKOkdZDWmhRFZkPHNE3bMu3PyHQTaJeLUkV7aWSGz0coM+h6KEjGPu+9ZgcfGdtF nPW000A8HT1C3nuR5jYK/0mjmXQV+quYltImuolep18pjlaDbaUd9CA9QgF6iVonD+h/+B082plD 9aynyUONidyT7tHgg0AlalqjuQ2hxravRuPGuD9G6H4M3ubGBCs9jSha5qlvvgvtr0ale9IcKMJu bxE2bwRvKHP87L03+FjwoYg+SKdsmkiTaDLlUC7aP42KaAZ6ZhbNpjk0V4bmIm46fhciNBWp8pFK8JpU82g+sJAW0WJagn/zwa/SIRG3QIYX01L8W0ZX03JaQdfQtfr3Uqm5BjHLZXgZsJKuw5u5nlZJ xlJpVtMaugFv7UZaR+vPGVofYiW0gTbiPd9EN5+Vb6oVugX/bqXNGA+ltIVupzsxLu6meyK0d0j9 XXQvbceYEXFboNkumYh9j161J2kPPUZPyb7MR6+pHuF+KZR9OB99cA1auDqsxqr/loZ6ayXaLtpW olu6DPpVYTmW6H4UKVcjpSpFvQdRyrURPXEL2qB4TYtUaItsf402vFfOpeX+uCesZ+6WIcEitWfj t9M2fIF1+C16VbD7wBXbLnm4/t5Q2h0yfD89QH/Cu3hIMpZK8yD4Q/Qwvu2d9Cjtwr8aHs6U3EO7 5ZsLUDlV00P0BN7kU/Q0VUr9ueL0pH9c6ytCmmfoz/QsRsgLtBczzcv4x5rnoXtRa/dJnQq/TH9B ${\tt WKRSoVfpNcxQb9ABepPeoVcQelv+3o/QQXqX/kYfGPXB/krf4Xc1HXS+ogY0CGvAn9HP99AUmpIwall} \\$ ZNrUKZMnTczOyhw3NmNMetroUSNHpA4fNnRISnLS4MRBCOMHXNm/X98r+1ze+7LuF1/UrVOH+Pb+ dmlbNLkgpmH9utFlorweBzOzQd2S/Sk5vkCHnIDdwT906EUi7M+FIjdMkRPwQZVSO03AlyOT+Wqn
TEDKwoiUCSplQiilEePrT/0v6uZL9vsCbyX5fZVGdnom+KYkf5YvcFTykZLbHWSgFgJxccjhS25R lOQLGDm+5EDKkqKS5JwklFdeN3qwf3BB9EXdqDy6LmhdsEAn//xyo9MAQxKzU3LfcqxL9cVjAlz8 cu60QFp6ZnJSbFxcltTRYF1WwDM44JV1+WaIOtMGX3m3vSUbK2MoL6drvWn+abmTMgNWLjKVWMk1 JTcGLuga60xPCnRe/lULNLkg0M2flBzo6kdhqWNCDzACTnyM31dynFB5/9EjtTW5WuOJjz10goom hroJ8cwJdUMN0b640FGXDZUJ1IdAoDg9U4V91BdbQQndu2YFzBwRs5djmo4TMcUcE8qe448Tryo5 R/9fUtQiUJznu6gbel/+j8d/xPsCVoecvPwiIXMLSvxJSarfxmYGEpJAEnJ1W5PLe3RH+twcNGKG 61b0zEB3//xAE3+iSgCFT7yDGRmZMovOFmgyOADDR+cKdE90EvXyJZfkJKkKirL86ZnP0KXuZ+W9 fLGPX0q9KEvUI9BsMF5Kh+SSzGmFgbY5sdMwPgt9mbFxgYQsdF+WP7MgS7wlf0yg82d4XJx8osyF LTBGFAQ7hRVJDBshr/Shr/SJZShr/SJZShr/SJZShr/SJZShr/SJZSGR/WFJZShr/SJZSGR/WFJZSHR/SJZSHR UIDiEMOBczDGYErXWH6tMjxEhkPBoRHRwzjaVxL1T80oEYX7dYhkwxeERns6DMvd0KdRL2yaKzjd/Cm5fl+ML6Ukt9ItzispT0gomZ+cU9RX1OEfNq3En5HZP1bWdUzmtbHLxaMaUaqR0jbxom6YexLL /ca69PIEY11GduYzMbBy143NrDANc3BOY1Z5e8R1PuMjSpBaU2iFUgR8IiBKGoNAlEwf+wws6GIZa0uFD0dXGiR1UawzKL/SVLoY1pnQ2UqXIHXiBy+pRRG6GNNtsm+aeD3XZBWV5GSJj4ua4VXivxEw /AMoYPoHlBump14g21+QGKjrTxT6gUI/U0k9Qu/FwDCaGegcMSeV5PgxT2FAZVKsoYaiJYr0Vbru 2 My4t2 KPZsVhqE0CsjMDdbpi7nfihyPdEIEcqIcEivNzRTloXKbI640flp+FYcsFIsmwQB2UUEeXgBQpMo8YjsiUj3eDFyjzFyMQKM4KZHUVD82ckSWHc0yAhvr74rWrMp0O4kHds0oa+XvKbxOfQnT8B2ckSWHc0yAhvr74rWhc0yAhvr74rWjULUQd0o1NpYhHEw7UUJ3nroeb5fkTl5/jQ2zblZ2Coq7k001ZpCjAl2h0KJKJjdSSJZ1nxdetH B+pcjALxX/C6F4tP0on3ZmWpysvQjToBnh0TqIsadQjrSp0BvY0oYaIu+H8jqiqSviSKSa+kMf51 mFlEpWUJXkQH6scPy8Xkr/LXhcbfhzNHiTmiri5jn9J6Rcvrod+t+LGV7kP+q+PCfi7q5heLgxiY FPsMBjZl1UQqAh07XtQtKlJbX6pLSqLqnzmD6q+o+iEplL5krBrKx1R+ZfSOUydP7qhzRHmdNT8N 29sNakLG00R2GfnPF55Y900B05t22UmUe0YcQdwRusN2KVbA0ky7gGQtUzTyganA9Vq/y9pNu5x6 NDESdhXKA5wE8pk27TJtdzhkJ8qrqEuANGA0sAL6NkBHezPSbSKvucl9xO6E/IA1WeJ6K0/z+dTa nkK7PB+g7C5ngBcYQf1/iNEKnp8o326HZwFOHngmuEKGkGjfEI2mQItQ+BtqGA6nHe08X9g11M7b $\label{thm:local} $$ hq6MhN2ReqCsNqfhReqn0UrK3yjmf0FMcr8QsG0qsw7QnDPBLqayYKa91HoKWMVIW4y6K0nT6A20$$ BhK1vsxKQ75VNPs0LIN+GW20t1GCcYTKjCNuJmRLyKFAR2AcMAZYAP0FQAs71srMAUTmAHej9TrK$$ $$ hq6MhN2ReqCsNqfNrsMAUTmAHej9TrK$$ hq6MhN2ReqCsNqfNrsMAUTMA$ BszPJG40v9H8G0p2iMo8HpR/awhbgWWSFwI7qfAP8WcFlFNovYJnAXY5FFFwhWQpR9MwBfc48HsonEWtrSw3qCTG4ybaDtyj5R3AYs1pg1VNcZ4BdHkkrDept7Ua7ywSMyhJ10rKQzQpAm3OoJPwdFewe9FWfD/ZGqOACRzZzqNszzBBQwFpc+yNwEygF+Vap2jy+cBcQPGeuyg+6hpF24+c3615/wiMjoDW e5ZEYH0EtL5W+jp4xuCws1fXxN1HFZzGFO/tRPHWProsErKtp2Or3cvdbQ92Txjv0w3G++5cyIaQ 2YAPWAhkAtOhvwDYau21G+w2tm743j2kkW/dD72GSAN0MVtLmWqcotZmNW31TBPPqoVRUt7nbpOy D95HbYw+Tddfwf0mfHdcTo75Bm1VcE9AzrXiKF0B4zbOreaws0cBZW01fkb6PRRn7gOEfI462N9Q nL34/IC+jvOmYnx/dH5APUuBm7RcC4wE1mteGg5rG7VzKumySFhLMSdtp3anoTNlaXil7EMLrVya xpfkF3nMG6it9RN1M1dijVtLbc3LKdEci/lsMVAqVu3qKKKqw+b403WoH11TAamr2g5Mj9BtA2YY LsJ3AfcBD0t9AZBjtUd5x6FLAaZL/Q5gpdUR4WH2zFAZ11r1EG4IXCB1u4BHzFuR/05gh9R9B3xh wsYwXwaeRNqXgM9hc0jro2oMcInxNuyQ94G3FdCWkQJo2xr15eZ1U14x/kVrzEvYXnHXCxvEysD6 walwameanngaganintoljozonciiikanyg/3-gajtatenkgot/32115221147187122211minckvEysJo uob6Khsi+JpY0589ELxXrM3KXgjCTXDHSDtgC7Xn9R59nKHWcLeZzIN1230Utolah7FeBucK6WmM Z2199RDd4qTRFCcteILXRLEWmqfkGuMPrWWYW/W6VWY/QYVq3ULbjrhj5Xr00V3A6451100JrSXL 1PphTaRUuR6Ezd0OekrM604m3SjWF4kS2FoCCfhOe2I8bsba1wPp/oQxCpj7MQeMQJzAIMxHy8hj 9qRSs6d7BFgONJTzyhNoXyHkHRjrJo20LHw7PCfMpk52I1qC/Fl4/50slmTZ4+gyjWuBZk5vGuf0 o3FodyPnESp1NtM0AXO9fJfR6CfxrnubDt0RQnuMe5fmCsj3OZJ2y/c5X2MJ31FHssJsx1xPEZ7x BqU6wr7S0PZgmrD1QvbWl2R5TgIfKLvRa9XYcfYJ9Z6Fncq2F9qpUI15oVS9a6c10hwHFtIizy8oow34D9TQ0wIyAcijyXYu5XmjwBfAvnOR/xfYbhjYcmz8SPdJ06mJRke872JqEGYPdXOWYQ0upgn2 esStp9uBLdrGGSfsF7S1TADv1pDjZZm2SR4BZuqxIuwutiO2Ycxug83dHe2IVuPFvg15ZiDdSZrj 8cPeSUZ4KjV3VkN3GPiKZlnHYL/0BHexvk+ltnY+gC8Qa7gh9Vj/7cHoFzG2DmFe36dxSKxBbibs

vOZinQhfwlH+ANgEqXYGxl4GbKoMrGlqDVwoljXrKYw3wG5KzTwmNXZm0FR7CNaxTnqtugToItef nbV003QbhZ413tE6oCtLretqPkWLgL0s7Zaw+Vrie9DSak6G+SnWhMeMEqvK2INwXYQvMq/CGgJY VbAnAe8A2hI06E5YVfRS6JubQzcAy81FaNMiyjbX0HhgsZmAeTUB+uEUAKafLR3KuhdYCiwDltgB mmVfCXugimYCVxr7aIN1GW1wsCY5WJu8/wKwbnj7K+nZTY8JwP8sdh6ggc4uGon2EvIOtB+nYdB3 AZBAKMynTPBngGEIZ0DOQV90Be91/Yq1eju+3xfgP25Huu2w0+JoWNSlmCuqML9/iTF+AV1o19JU 8wDm5SOUB6RjfLSzPoDsTSutCthsvTEf9MbYbkBDgT3AQmA64AMKgF1APjBGYjD6Zh01tk7HPHgV 5sNd1MEqQj2eRh8Mo+4YG6nWczQG9UkDNgEFQB7QF5gu67wd42c7xivSnFa/Tuddvx5nqh++j6HG v2FDBCjV3E2Dz18p3nwQY+RTmoh1uaf5OfSfwk75nt1h082DNMF4jnKAzP8mr7mN+hjH6RJzDPU3 7z7XPAr7r4qihL0h7ACxZnoKMBePpY12Mxq0b+4u4HbgdYkG9Ji3gdGXZfQousvTB75bIXUySmAP /F2uu/81jIMRezQtgabAhTrcOgxSF9pvQxf8bB7GPh0y8NChzWlKbDjnHsepWcB7028embU2osI ZfusOA5UKkAnzLEQ7pJYetLD+uU+7HGR8ABocf60kGsMTU+jXsY+L5GQrfjNAyTkv2Dd0PYqGWK kHq9MYXE2puBvu9TszfiPg/s1XK/1u2vDejYPix2jwEPATuA+4CboBd7F3WA0rD9hTigXZgstI+cBXpPwGkawl1aLhZS2ZHuz0Ke17h7iQqd9rCbBDywcW7DnCpwDeoPm0n4dMLmEH5ruE8e7nfDj2ht $\label{thm:condition} fks 3 w R 6 s 3 a 10 k/kws B Hh J 1 Q n 0 k 3 G g B A B C s z P D E f Y n O 0 4 x Z g 3 F 2 P N + V D y b K y 9 E 8 x 1 S S H C Y M O 0 mm B + S a 3 s Z M w V T 6 L s D U A 1 p C H G T B A W C 1 0 3 H N Z L A 1 h f 6 k H W C 0 1 T + B A C h u u 6 4 U A Z d Q T M n b R K 4 0 4 B + C R r w n Q K A 1 C$ 16HOgPSXbqU1+A6roW8CNJb+Vgh4pvCzhP8k12PgLuV7Ebnw2YIj8MxTCsGBCtUvC+jnNkH5qyGb ArcJWHcZI1R+1W5Vb+FrCR18WtejiXiW6AfRBn5mJGyDmtiGMUSUZu4UadEXbyuoPhN6+dz9AtbP j2V+DfodVLuqq8nsnUX/vJCHDQQM9B11XANzSSDA+pR4S31JPAfo3JQmYXqwJAnVohICxDWm2 SV1PCa23NIypGmOohcRfgJnEixijAPo/PRzo+0et5zFOWgEPBJgRIdEgAgaZ4RDPEP2Adsu+wLfX UPouCdRG+gTb4I+5FOuslPoRmE9nO/Hwzd7AmN/tvu80wFpRgnGbBr+lA2x1+KTeOpgbuyA086qn nO7iWaK+ch8fcwrqPBL+dz9ejyLXF7E+oPyP7CT3W2syxVrfYAOopWn2LPRtMvoNfjyee69ZR174 OvnwcVphHo+V7RFnEwpbw84jagHPXKOxCuglzyH0+Q0fN2h0EhLt6g0s4LMEYIc+T7gMyAEKhb/J OOOsIaJ9fE4QdkawNOKMYMh/cj4gzgHCzwKEDxs6A3iRmob2/UVfvuzeDT8pVjxPvosFe04XeBdJ 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XgSiu2iVoomo6zdq0qXsuHhyqxE2XA9Q7VVDDmPx6ViiGV2eexHgAEAFNhtJg0KZW5kc3RyZWFt DWVuZG9iaq0yNiAwIG9iaq08PC9GaWx0ZXIvRmxhdGVEZWNyZGUyTGVuZ3RoIDI0MTA3L0x1bmd0 aDEgNjI3MTI+PnN0cmVhbQ0KaN60Wwd8VUX2Pre9F0KLNIEgvPAIXUFEREAIIaGFkhBKQk0hIfQi $\label{thm:condition} $$ TbBEQIQAriKoqAioa0HQ19hwbeiiorjKuotl3bUXdEHBtisk7/6/M3PPy8ujyP52/4Ev55sz5c7M nTtzzsyEDCKqS6VkUebI7C7dfv3HU+9B83cgr3B2/rz7Mp7us3S0PZH1SeHihYHQXfveITL6EDkt $$ TbBEQIQAriKoqAioa0HQ19hWbishibariKoqAioa0H$ iudNm/3LL8PrEPlyiGolnzbrquLes1clE81DfMqIkqL8qUc+6vYp0U97UV6PEijq7m5QRFR/IcJt SmYvXDqq6zOfi3wHUZ9Ns+YW5ltT2w0lCq1H+07Z+UvnJQ1qi/J+2o70gTn5s4v+cdXjbxMd5/os mTf3yoWoN360x3H8vAVF82Y+ZoaJhnVG8Qlk2Z2Mm8mhOGeLcwlq3VJL6yCtNimOzPqOaZq2Zdqf 309idN+Fb3UTwnt8DShe5a1rvgPtj0aVe8Lsx2G3B4fNG8HrqxzH/feEHws/GNMHWT5eJtBEmkR5 11/2T6USmo6emUmzaDbNUaE5iJuG38UITUGqQqRiXp1qLs0DftBCWkSL8W8e+JVeiOPmq/AiWoJ/ S+kqWkbL6Wq6xvu9RGmuRswyFV4KXEvX4c1cTysUE6k1K2kV3YC3diOtobVnDa2NsDJaR+vxnm+i352Rb6gRuhn/bqGNGA+baDPdRndgXNxFd8dob1f6O+ke2oYxw3GbodmmGMc+R6/Sk/QoPUZPqb4sRK/pHpF+KVZ90A99cDVauDKqxrr/lkR661q0ndtW5rV0KfQronIs9vqRU65ES12Kfg9cyjUxPXEz 2qB5dYt0aLNqf7U2ulf0ppX+uDuqZ+5SIWax2jPx22grvsAd+M29yuxecM22KR6tvyeSdrsK30f3 /YXeM+qC/Zm+we8qOuh8QfWoP9aEP6Cf76bJNDll0NQpkydNnDA+N2fM60xRWZkjRwwfljF0yOBB A9PTBqT2T+nX94o+vXtd3vOyHpd2uejCzu3bJrcJtm7VtNF5CfXrlo6vFef3OZiZDeqcHhyYFwi1zQvZbYODB1/I4WA+FPlRirxQAKqBNdOEAnkqWaBmyhSkLI5JmaJTpkRSGgmBPtTnws6B9GAg9Ke0 YGCPMT4rB3xDWjA3EDqq+HDF7bYqUBeBpCTkCKQ3LUkLhIy8QHpo4OKSsvS8NJRXXjt+QHBAUfyFnak8vjZobbBQ++C8cqN9X0MRs316r3KsS3X5sSErOT1/aigzKyc9LTEpkVfpaIAqK+QbEPKrsgLT sIxRkQcYISc5IRgo+51Q+eDRIzU1+Z7G15zwMzHlJka6CfHCCXVDDdG+pCSuy7o9KVSAQKg0K0eH

AlsQWEEpXTrlhsw8jtkrMY3hcEypxESy5wWT+FWl53n/F5c0DZUWBC7sjN5X/5PxH/GBkNU2r6Cw $\label{local-equ$ 8VkcyElMCqXkovtygzlFufyWggmhDp/gcUnqiSoX2haTWhJzy/3JcYEcM9HK5bcFRWAgfgVT+yAi Aa9LBfmNpvYJ5BiJJMnwFC8FsxrlIGAlDxjMURZnHTA4MSk3Sf+cpUqJXp2c5FBcVFkJUETqpJ9z xqrp1FyhDoH0orSoCtYo1PEq6JV2+nqa3Bfeg5Ejj1/nYImykvHlQmeiGKXit9g0EKLMQE6wKJgb xBhKyczhtnFfq/ebkR3MyBqfo962N0pG1wjp+J46FKIkREvAHIAxOLBTorxWFR6kwpHg4JjoIRId KIsLZmSXceFBr0AK4AtCo31th+Sv69mgOz7NgZjdggPzg4GEwMCy/D1uaUFZeUpK2bz0vJJeXEZw yNSyYHZOn0RV11E51yQu40c1oAwjY3TqhZ0x96SWB401WeUpxprs8TnPJMDKXTM6p810zAF5qbnl bRCX80wApr3Smqx1JQcCHOCSRiEQp91nPgMLu1TF2kqhwoV7DFK60NEZVLjH1LoE0ZnQ2VqXonT8 g5fUtARdjOk2PTCVX8/VuSVlebn8cVETvEr8N0JGsC+FzGDfcsP01QnFB4tSQ7WDqazvx/p+Wu9j vR8Dw2hioHN4TirLC2KewoDKoURDD0WLiwzscd3ROUl/Sjyam4ShNhEYnxOq1Qlzv5M8F0kGMfKg HhQqLcznetCYHM7rTx55mIthKwUiyZBQLZRQyysBKQaqPDwckakQ7wYvU0UvRSBUmhvK7cQPzZmeq4ZzQogGB3vhtesynbb8oC65ZQ2C3dS3iU8hPvlGFrVQN8r00ZpEBPGwXN1J/jqoeWEQUYV5AfS2 TYXZGOp6Lo1P1JoiTI122yKF+EQvkrhZVnLtuvGhWhehQPxnXvsi/iSdZH9urq68Ct3oJcCzE0K1 UaO2UV3pZUDvIGoilwX/b0RVOelLXEzWHhoVXIqZhSutSvIjOlQ3eUg+Jn+dvzY0wZ6SOY7niNpeGfu01s8tr4N+t5JH73EfDF6VFPVzYecgLw48MCnxGQxsyi2LVYQmdLqwc1ystq5S15XF1T19Bt1f cXUjkpWBdKwa2sfUfmX89pMnTmyvdUR7ndU/9dvY9apDBjxeewcFzxW+RPdNhj2edtlplH9aHEHcEbrddimRYR2mXUC6Jwd6KASmANd7+13Wbtrl1KEJsbArUR7gpFDAtGmXabtDIdtDXg5cDGQCI4Hl OLcE2tkbkW4D+c0N7sN2e+QHrEkK11sFHp9HLezJtMv3HsrueBr4gWFU+JsYqeH7ngrt1ngW4BSA 54BrZLNE+wZ5aAw0jYS/ovrRcFrTznOFXUat/S3piljY7agrymp5Cl6k3h6aK/kTJZwrnInuZwzbph3WAZp9OthFtAOYYS+hbgyrFGlLURctAx46Ax2AVE+/w8pEvhU06xQshX4prbe3UopxhHYYR9wc yGaQg4F2wBhgFDAf+vOApnY17TD7Ep193fXW6ygbMD9RuNH8yuPHULdDtMPnQ/m3RLAFWKp4MbCT in8Tf9BAOcXWK3gWYJeDHwXXSFdyJA3RcH8GfomEc6mF1euGtcR43EDbgLs9eTuwyOOnwKqiJF9f uiwWlpvUwlgJdxaL6ZTmIU7J0z0xBilPo1PwddGwu9MWfD/jPYwAxknYP5fG+/4BGBpIm2evB2YA 3SnfOkmTzgXmfEr23UnJcYco2X4E/C6P94nByBh4et/iGKyNgaevkb4WnjEgquyV1XH2UQ2nISX7 210ytY8ujVVq66nYYnd3d9sD3F+Nd+kG4113DmR9yPFAAFgA5ADToD8P2GLtpRvslrTG+NY95KHQug96D5wG6Gi2UDLD0EktzCra4pvKz6qBEUre625VsifeR02MPEXXR8P3pnp3Uk6e+QZt0XB/hZxj JVGWBsZtklslYedRDZS1xTi0919SkrkPYPkctbW/oiR70bkBfZ3kz8D4/uDcgHpuAm7y5GpgOLDW 45uiYW211s4eujQW1hLMSduo9SnoQLke/Er2pAVWPk211mKs7gI080uaZY5QcrC5hwYZL1Eb83a8 o29o11FI+cZs932EZxmTMZ+NRdqvFNJVPuQxfoHsSqnG5xTkPOYN1Mr6njqb12KNW02tzMso1RyN +WwRsIlX7ao4osrD5thTdagfWVMApavcBkyL0W0FphsuwncC9wIPKX0RkGelQXk/QzcQmKb024Fr rXYIDwFmRMq4xqqDcH3gPKXbBTxs3oL8dwDble4b4DMTNob5MvAk0r4EfAqbQlkflaOAi423YIe8 $\label{eq:condensity} C7y1gbYMZ6BtqyCXmdcpudj4F60yLxZ7xV3LNoiVjfV1FfXSNkT4NV7TtL0QvofXZm0vh0EmuKOU HbCZ2sh6jz701mu420T1wbptPQLbRK/DWC/Dc1j6GuKZWE99RDc7mTTZyQz/Kmsir4XmSbXGBCNr HbCZ2sh6jy701mu420T1wbptPQLbRK/DWC/Dc1j6GuKZWE99RDc7mTTZyQz/Kmsir4XmSbXGBCNr HbCZ2sh6jy701mu420T1wbptPQLbRK/DWC/Dc1j6GuKZWE99RDc7mTTZyQz/Kmsir4XmsbXGBCNr 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3GJfotbQVOevtMUJIzyU4p3R0L0MrMPY3oC6vQp+gHra2e6vvDbjfTe15qBtHjBWf88w7zLizbvo RYb1JN0ATFb4CGM7j44C5dZUWoa1YArGcUce08CzPL6d1XObdOtZLxLvaA3OSaSn62O+ROuBvSLt ZrD5muF78KR1Phnmx1gTHjPKrErjUYRrI3yheSXWEMCqhD0J+PvS5mhA96tVSS9FvrnZdAOwzFyI $\label{eq:ni2k8eyqGgssM1Mwr6ZAP5RcwLQzpUNZ9wBLgKXAYjtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HGQbDv1gD8DDEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HGQbDv1gD8DDEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HGQbDv1gD8DDEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HGQbDv1gD8DDEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HGQbDv1gB8DDEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HGQbDv1gB8DDEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HGQbDv1gB8DDEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HGQbDv1gB8DEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HGQbDv1gB8DEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HQDbDv1gB8DEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8fLX276TEG/M9S537q5+yi4WgvIW8/+3EaAn1H8HQDbDv1gB8DEU4G3I2+qITeHfrR6zVARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX8flARAYJtEM+0rYA9U0gzgCmMfrbMupXU01iQHa5P/XwDWDX9flARAYJTEM+0rYA9U0gzgWDX9flARAYJTEM+0rYA9U0gzgWDX9flARAYJTEM+0rYA9$ 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$$XJ/zc3iFr054ueI/hK/zOeGFzrDw28Auu3X4mPVVeJNzPurRMHytvS28E+FBGvo8xMlU+Zb76oaXOlvCOyPh88JX6zDKygzv0ndQzp7W34gm+xu5Pv9T4eX+P4eX+iexzgsfCl/N4cj9kd/G+P8gbY18Auu3X4mPVVeJNzPurRMHytvS28E+FBGvo8xMlU+Zb76oaXOlvCOyPh88JX6zDKygzv0ndQzp7W34gm+xu5Pv9T4eX+P4eX+iexzgsfCl/N4cj9kd/G+P8gbY18Auu3X4mPVVeJNzPurRMHytvS28E+FBGvo8xMlU+Zb76oaXOlvCOyPh88JX6zDKygzv0ndQzp7W34gm+xu5Pv9T4eX+P4eX+iexzgsfCl/N4cj9kd/G+P8gbY18Auu3X4mPVVeJNzPurRMHytvS28E+FBGvo8xMlU+Zb76oaXOlvCOyPh88JX6zDKygzv0ndQzp7W34gm+xu5Pv9T4eX+P4eX+iexzgsfCl/N4cj9kd/G+P8gbY18Auu3X4mPVVeJNzPurRMHytvS28E+FBGvo8xMlU+Zb76oaXOlvCOyPh88JX6zDKygzv0ndQzp7W34gm+xu5Pv9T4eX+P4eX+iexzgsfCl/N4cj9kd/G+P8gbY18Auu3X4mPVeJNzPurRMHytvS28E+FBGvo8xMlU+Zb76oaXOlvCOyPh88JX6zDKygzv0ndQzp7W34gm+xu5Pv9T4eX+P4eX+iexzgsfCl/N4cj9kd/G+P8gbY18Auu3X4mPVeJNzPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOyPh88JX6zDKygzv0ndQzp7W34gm+xu5Pv9T4eX+P4eX+iexzgsfCl/N4cj9kd/G+P8gbY18Auu3X4mPVeJNzPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOyPh88JX6zPV9T4eX+P4eX+iexzgsfCl/N4cj9kd/G+P8gbY18Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8xMlU+Zb76oaX0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8x0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8x0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8x0lvCOYPh8Auu3X4mPVeJNZPurRMHytvS28E+FBGvo8x0lvCOYPh8Auu3X4$ $\label{local-charge-decomposition} chcFGOnJUR6U3rufshH4HbApKrwxKszIjeLnl87fp2F2clcDK4EChMkLM/KABLNb+G2Pfw8sBzoA04GS09yZqwn9nS727sKs8LDqNOEGQAJQGnV3pj8wn+/QyH2Z/w/8J/d7/6O7wM/8NrzzriEeYvny$ KL/8tzD3XNL5+vw29BmbW+Ch6NSwm2AcCX8D0dW7s7Xe2yv19vZIznof0L1PwL44z7X/M+n+bK0F YvSRu2D/I/gW/Tb0Zc4/l3n4X0axclk7Yudz80Gx4VPmw0bh/BrzIcJif4jNoc7Iou2JaB5lT0Ts hzraLoB/cJXAGaHui8Wru4XF8Hf7o64V+h6b/Xtv738GJTp1qL46ay2nXf6ekJ20XVF9FxF+02L4 2u/AfriTFvK9NGC38wu1Z/A90L4fZ09B3npkRc4vkM7v1+dAcs5jHaZcPpNieHfqGte4Vxd9T1FAwyL34xgLaD7fueR7cKo9N+hzBrTxUt8kusx3AV1hN6cr/PXJ4rMipzFNcJLQhjdovFML9ZoC//1j7Wfy3oulDb78Xn1XDP2p7oRZ/OT8IPTZfMzj7yP+OORCrBdsBzWjeOVzMiqoA2ygeOtb2Mx7FbbY+6kZQ90/exvhJGrCeyT2aO9e2FM0hfvKOkQXyZkC/NOxkb0lfW8tjvdf7GzaDNweuY8GWOvIrnE3 eC914LtwfMdMtadc71mzD+wbQ3nOXWjXHyjD14qa+DJRj3TKtK9HnX1fvxPq9pC6h9dOzRmNII/QDuegdy+whb7/B7RDPc6370CcgXlsCea7e6l12XZR9OTthtTDSacW6P/ZfN8P2OGMpACD7xWq+4Yu 8o4nQ82ZO7x7gV14T7h6P5n/LoPLZ3h3FC21B7yWtivIHUS2M79Qdw6rcQLpG+FZK3V77PO9fcvD NNRZA+TSAut9WoBxbPiaoO5r4L+noO21VGJPRL1q6ceRvh/M0nwM4L9TGqNdJuRzwBaK+qMm9+9A sl2P+O+a2qjvs9L9lXlyK4fWiK9u3w8sNuIRd9K8Ej75dzRS/l4JNno7vmPG+35ORwr48zC+B6s7 $\verb|nwHnZ3XW18| | fYdxD1M3u5YbtFZRkV9AEezMFkDfAZfD9M4D76ytnK33F94v8B| j0HWWCPMt6zR9ELN8E3IuN5DeHuL3z+i7ZP4O8ZZc23D1Ivp4AWWq9TAuq0ye5CU+ym+EbHU7ZdG99af5prtcX74vux| | fyddagaethau fyddagaet$ HuCb7fWwX2Gnu55hf0K5/p8o3v8ZNfLfgW9yFuqKOcipTW18D0LupzH+fvge3qAkvt9s76EWcRPV t9+b0zK4fc4Mau10V/crE53HIEsp0Vcb39QIasJ3fq133H3+d1zpu2m8LxXzC9LzGPftodnOH/Ge s6kBvvMdeO5AtInX/9bqLvNF1Np/nIqd+lTiC2EsIr11N/Ca8ks/xHvZoN9xOIv/Vo19TuM1vH/e $\verb|byt3M+K30xP2IdpoHqKVDPAKyHms/y3Anxysx1DV+TKaIncj2kQhKsz7NZF14H1132G9k218yXfU| \\$ JS2nwQ9WBPoUOMp/vlejvLMg9idSn4G6TOV71/fu5w/04gZ7uFdD1XGKSn8PwLf4W3u8Bs7gi9RT $\verb|ilb1910j2| a Lsqvmwj72r4E0Z7An0M/4equaA0uAkUQnw8AJvAc6szwbqg5CdtU46Z6KSvm7hN2eBKoSPXSPQZ6HKz1gtFVNicF1GpU7I0fquzeV3wM/eH8nwXjUe16xF+7igcNTvDofh5wN+SPkfA/1$ 3t9gHPfQRbeB+0rvfXjx0cAIqLoK8iONqgyNyoc0VLkPaFR+DjnMg5eu61roP670X/k7728yorERuN3DWA+3IO8KD/M8nPAgfXWVh995mONhmUblSY2qpzw85KHEg9cvkf4QjAbaeujgoV0MLq2J6PJV Pwz0MMiDWROqb4u9v5+Jxg4PZ9JfFgMZE9v0mKiGRD8vNr8aq2bUmI0pp+p5jUp83ZX3aVT9uSYq ZzB4jwF+wgENas7n+6fcH/D09c5ljyz/hH0N3Yf5PUijKbGilhXYY656olZTYyjISiErhFwvpFTI ${\tt dUKuFXKNkKuFLBeyTMhVQpYKWSJksZBFQhYKuVLifCHzhMwVMkfIbCGzhMwUMkPIdCElQqYJKRZS}$ JGSqkEIhBULyheQJmSJkspBJQiYKmSBkvJBcITlCxgkZK2SMkNFCsoWMEpIlJFPISCEjhAwXMkxI hpChQoYIGSxkkJCBQtKFpAkZICRVSH8hKUL6Cekr5AohfYT0FtJLyOVCegq5TEgPIZcK6S7kEiHd hFwspKuQLkIuEnKhkM5COgnpKKSDkPZC2g1pKyRZSBshQSGthSQJCQhpJaS1kAuEtBCSKKS5kGZC mgo5X0gTIY2FNBLSUEgDIecJSRBSX0g9IXWF1BFSW0i8kFpC4oT4hfiEOEJsIZYQU4ghhDxiuELC QqqEVAo5KeSEkF+F/FvIv4T8IuRnIT8J+VHID0KOCzkm5Hsh3wk5KuSIkH8K+VbIN0IOC/layFdC vhTyhZDPhXwm5FMhnwj5WMhHQv4h509CPhTyNyEfCHlfyHtC3hVySMhfhfxFyDtC/izkoJC3hbwl 5E9C3hRyQMgbQ14Xs1/Ia0JeFfKKkH1C/ijkZSEvCdkr5EUhLwh5XshzQp4V8gchzwjZI+RpIU8J eVLIE01eF11hpFxISMhjOh4VslvILiGPCNkp5GEhDwl5UMqDOn4v5H4h9wm5V8q0IduFbBNyj5Ct Qu4WcpeQO4VsEXKHkNuF3CZks5BNQm4VslHILUJuFvI7ITcJ2SBkvZB1QsqErBWyRsiNQlYLuUGI LNdimRZXVVzQH2JpxQUDIJZosViLRTpuoQ5dqcUCrZxfcUEqxDwt5moxRyeZrcUsLWZWtEiHmKHF dC1KtJimRXFFizSIIh2agkWhFqVa5GuRp8UULSbrfJN0aKIWE7OYr0WuFjlajNNirBZjtBitRbYW o7TI0iJTi5FajNBiuBbDtMjQYmhF4hCIIVoMrkgcCjFIi4EViRkQ6RWJwyDStBigRaqO66/zpWjR OUgrG2rRQIvzdFyCFvW1sp4WdbWoo+NqaxGvRSOdF6eFXwtfRbNMCKeiWRaErYWllaYOGVqQEoar RVglMap0qFKLk1qc0HG/6tC/tfiXFr9o8XNF09EQP1U0zYb4UYd+0OK4Fsd03Pc69J0WR7U4ouP+ qcW3WvmNFoe1+FqLr3SSL3XoCx36XIc+0+JTLT7RcR9r8ZFW/kOLv2vxoRZ/+z/2vTs+juraf+7M bG8z24t2Z1e72tVqJa16t3Zky+rFKusud2xscLcw4IoxTgg4NIdgAgkktGDA1rrJNsVJTAhJAIcA CUlwzAsJBp6ISfIIxZJ+586dleTCe3mf98/vfT5v8Xe+d+4UzT1zzrnnnjuQU94me7819JuUYwbQ WynHdKA3Cb1B0n9N6HVCvyJ0mpzyGqFXSecrhH5J6BeEfk50eZnQz0jnS4R+SuhFQqcI/YSc+W0y 9yNCJwm9QI49T+g50vksoR0EjhM6RmiQnHmU7B0hdJjQIUIHU/YEUCplnwM0Q0gAof2EniH0NKGn $\label{eq:coojg} COOjgTKDvEa/ZDc5Qlcj5NjjxF6lNAjhH5A6PuEHib0EKHvkzt919zlQUIPkGPfIXQ/ob2E7iMXfJvs3UvoW4T2kGP3kLvcTegucuxOQncQ+iah3YRuJ2feRva+QehWQl8n9DVCulK2hUC3pGyLgHYS$ ujllwwq0g9BNKVsSaHvKBsEYbUvZyoC2EtpCLt9MrttE6MaUbQnQDeTy6wltJHQdoX5CGwitJ7deRy5fS2hNyrYYaDW52Spy5kpClxK6htAKQsvJdVcTWkaebCm5/CpCS8iZiwktIrSQ0AJC8wnN10L3 kSebS2gOEXo2ufUs8odmEppBHnc6+UNJcpdeQj2Eugl1pawi0LSUFf+FzpQVm3dHynozUHvKmgfU $\label{lognormal} Rk5pJdSSskJegJrJXhOhRtLZkLJuBZqasn4NqD513QY0JWXdDjQ5ZW4AqiMkEkoQqk2ZYXxHk8heTYqfBVRNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfSPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfSPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCyFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCYFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OoJFSR4huBylP8TKCYFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY9OOJFSR4huBylP8TKCYFD8bqJQcKyFUnOJzgYrImYUpHgtWkOKxb8YJ5ZPL88hfXqfNqCrFY90OJFSR4huBylP8TKCYFD8bqQfNqCrFY90OJFSR4huBylP8TKCYFD8bqQfNqCrFY90OJFSR4huBylP8TKCYFD8bqQfNqCrFY90OJFNqCrFTP$ yCUUIzfLTRQlN8smFCEUJpSV4rGWQoSC5J6Z5J4BcjM/uYtAyEeu8xLKIOQh5CbkSnF9QM4UNw/I keLmA9kJ2QhZCVkImckFPLmAI50mQkZCBkJ6cqaOnKklnRpCakIqQkpypoKcyZJOhhBNCBGixFHT IgFjxLRYGDYtES5A+0vAF4DPoe8z6Psn4FPAfwD+Af1/B/wNjnDC++cBfwV8DBiC/n8HfATHPoT9DwDnAO8D/mJcJvzZeLXwHuBPgH8DvAt9Z4H/CDgDeAf2/wD8e8DvAG8Dfmu4RviNoVB4C/hNw7XC G4aw8GvA69D+1SEmnAa8BngVjr8Cfb80rBR+Ae2fQ/tlaP/MsEJ4ybBc+KnhauFFwzLhFFz7E7jf jwE/AoijJ2H7AuB5wHP6tcKz+nXCCf164bh+g3AMMAg4Cv1HAIfh2CE4dhD6UoABwAHAft0NwjO6 G4WndZuFp3RbhH26rcKTgB8CngA8DngM8KguT3gE+AeA78M1DwM/pLtG+B60vwvtBwEPQPs7cK/7 4V574V73Qd+3AfcCvqXYA7qHcDdcdxfc705th3CHtlP4pnaZsFv7qHC79nHhFiZL2MlUCDejCmFH cnvypn3bk9uSW5Jb921J6rYg3RbPltYtm7bs2/L7LaJZqd2cvDG5ad+NyRuSG5PX79uYPE7vopbS t4glyev29sf2fmv/hn7mH/loXz+q70cF/Yim+rl+fz+j35Bclly/bl2SWjdt3f21B9axlQfWnVlH U+uQdnD05MF1H18DsLh5nYFrWJtcnVyzb3VyldKVyRXwgMsrliWv3rcsubRiSfKqfUuSiysWJRdW LEjOr+hLztvXl5xbMTs5Z9/s5KyKmckZcP70it5kcl9vsqeiK9m9ryvZWdGR7ID+9orWZNu+1mRL RVOyeV9TsrGiITkVhKcyuAx/BsPhB+jIgCehPGhygUf0nPWc97CU54DnpIcxm9yCm46aXGhKpwut dmlz3eFiTM7XnLTojOY2mByvOf7o+KuDtYiOaH4DZefsfjtjw7LZ23sbJE7UEy4slWRttwfDDSYb MtkEGz1VsCGKP8uf5xnbC9xrHG0y1ZNp1ESLJjjdZBSMNNNMMGhnRWFjeYDIIBhpvRg2MXTRAD75jRD+tt8GkE3R0MqHrlNGiLjGlQdTlFTRQDPIjRCEOiFHjp0A2oQH8+qadKRCM5wO9PbFY66Ca6m49 oJ425wD6+oGsHrwVu2YfUH79AJWcPWfmAELfnDWA6Cm9B6ytXbPJ/i27d1OTva0HvD0zDzzkndV6 YDs0RNwYhQblHbBTk2fF5q3vXx+LbZgHm3nrN8Skf7CH+vFeDHfif+s3wD7+r1/ap2L/6Y+cBjR/ Pfw2pDs3xP5X/9D/7sf//+E3QIGJzqwbpXdSS+ibATsANwG2A7YBtgK2ADYDNgFuBNwAuB6wEXAd
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JMmApOEdoCuJ18jrTwo17SifMytFsH1ReWohgPzHDHoID7C3AdV4oNoieDLX/2shGhsPV5cnvSdM $\label{eq:vs0c8} Vs0c8Fi5y6/KHCdrvLuPvpV0aS3UI9v3uEJ3FbrSPULoNCU+q2+yME1zVpPZpwRP10stdAuczSP+EWuVfbLotmA265nmAmgvs+h0vRf+UDUwdcRsMZFdAubs+c+4QHqboG+13h3vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+13h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+13h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+13h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+13h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+13h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+13h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+13h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+13h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+14h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+14h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+14h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4QHqboG+14h4vrVDsqR7v7ThV4vGaRsMZFdAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qHqbqAubs+c+4qH$ CbKw0xKLepd05j7GJntJZ+i7LZ6ozxN1C9nHJ12A7jPaFdJ7tjgMvfGOmAXoDQyCWAIqShwnqf7PaparduqD8w9kPaQv7A9A/8xGRReXllRUevTN6jM30V4zNWeDyRWSGozYwNiXkqkkiw/7G5jAzJpti4/bY HDy8v90GMGjzeYai7kQOJD2PTMJxHEQMIvlmepg9khMnkn3CUIpyuVmRZYV+jXfwLFUXj0bjRVE+ l6N+T/YQ/ph9AEVRYdpFE7NPE4eD1tLDaFdYuAc114PG5BKBOJjhyp7xzIIUrXE/9wb41xs3bFzH YnuBT/YrVrqudWYw3NBajXkx6PYERYrd9GZ27clT2Y63rZLAUpyZ3fruB6d37frpP73Xw3AcmGCR 90g06NGH0KMIqj605Nx8TNbn86Q8Snoma01QguYx5nqYqBrPVTL1x446ubaGKtbtmsct4w+DM1fX0VbFL/sLbJhd39nZyVBi00MKSmaqZ4jy7Tr9wbtbWTNHsYJkfQsf0nUSH3qTFy3Q044Zya4EMu+jhuj97F2afVmF1qF02rGsbs2aphvn+xzJpijrMA9G7f3Tr1eJp0+0yA31Iw1fnOJoyrv3WpabK2CP 8rmiJPzqdns8blrLEgRHo47eP/uWhlvbD/Q0zr7lQBsp05KrdqQX9q1KaOXOlYndtNWtSC6biXJZ I5GAFA473e6BktkJd02Zd4bDa9rLSUFXqmyGS19uPZCZ3dSzv711f2ZWY8/+jkWDbWUV1/c1XzfY 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zXN8grPYTKPrTVaB43ibGds/ISvcNCfweAZjhYESHHTuHMwM2QUkimMS/Yrs13j6g0ctjC3kkbyi lfshzTCYMQncpQ085CfWvh+o/TjI9Bz0SNpWWocTIVxaQHzD9HDedKSxm0ixWxuS3Krmg1DJY9VF $8 {\tt EUNOq0bvk/dhYQccQTiCQokTi/NbFDVBhC+1LFqN5dqExuGcUmeQrmIWLm20EZiiyPjm8Y0Gmk+3xTiEDfuinQvTk+agMmFlur5OAtj7Git3eUw0RaH9dKNmQY5WLuqRkv2AqeDoVizt2nttqbOhzak}$ 31vu7Ruhqs00gV1K81hNYsjtDHk8NmxZf/C2TY1ES2NhYUmhWQ65HG7R7opFvbXr71g4Z8+BZ/tP 8r12fveATTg19FuD2e0oA0gWJCTrwJVm1Eo1UfxKjW6VhG6Vw1Rt2rKiLb5ihVfBLWkSg4jDLXHi GqfhbDxN2wNmMR911J4MqFqiRU5kA0D5o5q7p2VHEf2266Jp16XdThinABvsTWRJsok46cvLm7Am uroIpy3kZJPUJLnrhrGQtixpK/tYVdklJEVZGE9RLj/fII5nKYPbXZ7LOtWjllqyAVnGkhvE/Hpf YmKjUd2k2GVu00YuYpc/Mx0TXSGaPjhn8Jltc3etaXSYOdpu42vb+hbM27KgMNF2e8se4JWJE+z8 rrmzJcX+mtWljV3LqyzEm4T5jMLY3pfuuG9dUp3T0T5/bUS9689sLXeVRC222FuFwuqRWrhnPaq +jXpQlAPl+JzmArTa+tLltSFoyUwcwi4HR7JrgCfU9cPLZqdWd0gUKbaVdvA9pNM0B+zTjQD7NK1 dCMJpCRxcRmOFeNYHBcFcTyAo5qBKvLiIq+Ou3HcheNOHBcxsDjG4hiDEwGsWSs5Z62Sbi9U3Kqo r7Xn1tjPvEjW4IOplDg8djldAHeIRPlEIhEiCS+KZBARyVRRJDtLixGTs1UMDAD51KW0heQsMRX1 xYGUxmAmeRFFS6TVksutBa2rP19VpUcCEnqUlWykGclv1NM18IoPnpqoM66aeMJWuXEUR+gf0+WD +f1Go+esog1mnBYTfo9VQmWhSGVIPCi5st+msuvwIbwzEs9+1A8tYpETQ1415PPYaJn4s6zZx19+ PUr9crQRjY31ZzgUR7+FiAZuBs48y9pRGJ06jiTQKIsUwcs1UdQ3SkzdQHFWt96/0yg0qIURxeH8 U6KYC3hpT4n6U9plgUQqh0TCTk4PUka0fQDAyQielLr4gZY55dLHiUlZEWf1TXBnjsIzLlYaxskX /KuF8YR2baDQdCihRxXzwcWJuKIWkInosW/N4D1LszyXTbEOT8xfGJcoDp8b/ZaisBY7T12wuwS0 $+ vu510CzXzphBfeFA0eGWVoSU8DacXIQ6R88byqozi\\0 + bu50CzXzphBfeFA0eGWVoSU8DacXIQ6R88byqozi\\0 + bu50CzXphBfeFA0eGWVoSU8DacXIQ6R8byqozi\\0 + bu50CzXphBfeFA0eGWVoS$ vzoEOr7eKKi5OoRmTSCc+vJQN03C2elRCPYm+s5n13b22hB3T6DYPBUljlwdSh/86jDjulaPMnCFkm99GqlzCJV/z4ABAwYM/H8H2Uxw1Xgyh8oKwOAknJxAld0IVdd8Cdz9BThxdai5CaFa9PtHXej/ Burv+Hpg5hmEGlcg1LQfodm7EWpG0kSE0isMGDBgwIABAwYMGDBgwIABAwYMGDBgwIABAwYMGDBg wIABAwYMGDBgwIABAwYMGDBg4KsHohDWNig7EUlqVAhxlEXbsYz+5x966ZSj0+m7tLKd7Fmme+lf 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XXLlZjg7fY96tOMh6FP+7s1QbofjLuhZRms/9bRaVVFZpbZkNvf3DfRtHVTn9/Xv7OvvGsz07Uip sQrw5Ecg2xsU5XAJsQ/HRNABrGkSO9yafTn4g420Wf+JfGZNtV76t73vkPLtn7zwh5c+GX2A/5XpGBzy+VH8vwUYAB+utTMNCmVuZHN0cmVhbQllbmRvYmoNMjcgMCBvYmoNPDwvRmlsdGVyL0ZsYXRl RGVjb2RlL0xlbmd0aCAyMD4+c3RyZWFtDQpo3prAQE+gwDAKBgAABBgAQaQAsQ0KZW5kc3RyZWFtDWVuZG9iag0yOCAwIG9iag08PC9GaWx0ZXIvRmxhdGVEZWNvZGUvTGVuZ3RoIDEyNDMxL0xlbmd0 aDEgNDIxNTY+PnN0cmVhbQ0KaN60mwdgVMX69t9TNw0IEEIJhA1LIkgJ0jshjRJaKLpBwCQU6eYC IqAUW8RoLMhFURC8FxUQdRMboiJFxAbYEQsqIqCCogIKhD3fM/POLpslCve7/wv8eM7UM2dmzsw7 M2dJI6JoWkQGtRk8LLVtRfTLteHzKsgfO3uW07Vfh35EWkMiO2JC0bXTHvsxfQORqylRZO1rp86d OHDljOulCu9GnOKJ4wvGHX293SGiNbOQvuNEeFQrrZVDFNsZ7qYTp82aU+fVs3PhHkXUfenU68YW UHzccaJxcXCvmFYwp6hhnbpPif1wxHdPL5g2/ot3bZ1otY/IWFM0Y3zRzuOzWhMNQJo6K8gw++uv kkURlnKrHUqQyGq8T5t0iiC9hks3TNPQzw9Id9Jog4NcxfPSwGFuN7mJ/I5NftLecD2qp7hJWyXC jClWdXF31Ai5HkWcB+j8n5vxdwU9RS/QJtpK79BH9LsWRf10071039GP9Bud1UhzaXW0hlpz+j/7 47/VmkbVjClkU10i54zzg3+d8wMRSnre5wG46pop532cWs6xcD//A/6N/t12NMXKtLH6u/A9rhlz zui9hNvpKNz6HeJapjjuetT/rH9VpeIUOQy6nubQXJpHN9J8WkAL6VYqpjtoMd2JuliI67vobiql e+heuo/upyX0AC21f9IyepAeouX0MD2CelxJj9IqFSbcj+LvMhkqQv5FT9A62gD9N62hx+lJWgv3 $\label{eq:condition} $$ \text{etT+BnoGfuzD7qfhs5oeg+8T8BWxhN+z+OujMiqn5+h5tBm7A66NtIVepJegL6M1X0Gff402ox23} $$ \text{oGW3ST/hE3D/dUz+fzu9QTvoTdpJb9Hb6Bnv0nu0i3bTnv+vkB1BH+F6nz6gD9HXPqZP6FPaS/vo} $$ \text{oGW3ST/hE3D/dUz+fzu9D} $$ \text{oGW3ST/hE3D/duz+fzu9D/duz+fzu9D} $$ \text{oGW3ST/hE3D/duz+fzu9D} $$ \text{oGW3ST/hE3D/duz+fzu9D/duz+fzu9D} $$ \text{oGW3ST/hE3D/duz+fzu9D} $$ \text{oGW3ST/hE3D/duz+fz$ C9pPX9M3dAC97ugF4Z8hxueI85WK9S1ifU8/IOYxxOR4HOdLGXpE5vAx0n5DB7UIOqnpdJYcXInW WyZbaLlsR9F6onXWyHoW7fEs3KKFngy2zdOo46fRnsIlrh9WrfEM4pahBgP1V3Wt7Vatw/X9KuKI uhAhu1Rd7FQtIfLZHEz7rgwrl+m2BXM9X6P8hJ+E1M6XIXX4PR2SNcO1x6Hna0/E0Ig4opZFHpXr 9qDScu2LtMI/NI0I+xzuHzA6HEVNC/1JtsRPdDh4fViFH6Of6Rc6Kf8/Tr9iPPmdTsB9Cj7H4br0 N9znD/z9k07TGbRgBZ0LcZ0LCzmHoc/BaKVpumaQ//zVeV+JqVmajTEtQovUorQYrZpWXauhxcKn ckh0MKTmBSExVYRFSp9aWm0tDuN1Xa2e1kBLwLjZSEvUGmtJWpOQsPrBEDdCPFpTLVmFxcuU9YNp GyNG3ZC4zbU22g34v4XWWkvF9RVae62D1knrAp9WcLeFuyvC2khNpyFUSFPpjHVEfw/5x2FUKUvL vmbM6FFXj8zzjhg+bGjukMGDBg7I6d+vb5/srMyM9N5pvXr26N6ta5f0nTp2SG3dqmWzlOSmniaN 68XVjKlRLTogMsJlW5iENGqZ5cnOd/tS8n1miqdv3lbC7SmAR0GIR77PDa/synF87nwZzV05Zhpi TgiLmcYx04IxtVh3d+reqqU7y+P27cr0uDdqI3O9uC7N9OS5fcfk9UB5baZIRzU4kpKQwp1Vb2Km 26flu7N82bMnlmTlZyK/suioDE/G+KhWLaksKhqX0bjyNfMUlWnNemryQm+W1bUMU3A1cVufkZxV MM43JNeblZmQlJQn/ShD5uWzM3wumZd7kigz3eUua7ml506NsVSY3yJmnGdcwSivzyhAohIjq6Tk $\label{localization} D1/NFr7mnkxf83kH6+GRx/taejKzfC08yCxnaPAGms9KjvW4S04SCu85drSyT4HysZNjT5K4F18YrCaEB64JZUMJ8XxJSaIsd21Mo014f1tyvex2U2FC0aWltsjz6fkiZEsgpM4IEb1oEBJMnu9JEk2V$ la/+zZ5Yz7eo0N2qJWpf/kvGP4S7fUZKfuHYiUILxpd4Mj053oZ7fWmZuEgrUM+aVdYmFfEL8vEQk0Q15Hp9qZ4iX5wnnSPAwy3aYNIwr0yikvniMnyw8VQqX2pWpiiXO6skP5MLKPLy5Hpfpnb0N2Xt 30nPtaP2lCfK4YvPQK0KZJV4x03wNc5PGIf+OcHtTUjypeWh+vI83vF5opU8sb7m3+B2SfK0MhWe LSx2ILJ4cldyhNurJxh5orXg4c7Gf5707giIRXNJp2jR905ur5ZAgWi4i4ohrir1A4eRnNFXBBki aUbfhKS8JP7zN0VKUGWykn0RIXnFwiNYJr7PXxaNY4sCNXdnjc8MKWClTC1VQJVb1eXURV2oGyNF hGjOvoBgIxlvLvx0ZCO9RCvWc/toiNvrGe/J86APpQ3ximcTdS3bN2eYJyd3pFe2tuolwyu50Lwz u3yUhOCAQ89AH8xukRBoVunuI91BZ9+w4H6BYHdJhCdnWInI3KMyJDfeIDy0ndKv4K70tdrj1czG 60bJLvC4Y93ZJQUbnUWFJWVpaSVFWfkTu4o8PP3GlXiGebsnyLT09c5PmCduVYtytJzh6alaYuxJ L/Noi3PL0rTFw0Z6X4Yt61483Fuua3pGfnpeWV0EeV/GCiBN+urCV3gKhls4RE5D4YiQ8RNeTiNa JENN6SHdYzdqJP0iAn4ajd2os19swb+Hn81+adJP/EBj1ZuIKsZwm+UeJ5rnpryJJf154uWieDQ1/mk+zdOTfLqnZ5mm2zG+KM/4dF+0J1349xL+vdjfFv4udAzMhagcMSaV5HswTqFDeS1B465oiCzd Gx1nuDdpV8KxvCR0tVFgpNcX2QJjv5XcH/H6CPLh3ce3aGyBKAeN8Iq0ruR+Y/PQbQMZIko/XyRy iFO5IEa2TCO6IxKNRdugAWX6RXD4FuX58lgIm3on5cnuHOujvp6uaHb000oRN0rNK6nlaSvfTbwK ucl3CIlE2WiYl30S4MTN8riSXDEo+VgPgsbmulHbJo0dhq7OY2lUAvuMx5BopoyXRCWoQBKPZSRH V4vyRbZGhvgnrqNbi1fSSnb15XHhpesOFQH3jvVFo0QpIVWpEqB2ENRP1AX/7kBRrdStIpvcjTTU Mwcjiyi0zMmFYF+15H4FGPw5fTR8PJ0DiSPEGBGt8niDfV3iyWNQ70by8I3Ok565SSF/WrX0iMlB dexKeBkdm/JKwj18V7do1TIi3Lea9C4piahWdQKur4hqQYWnXEfz2j1q9dnPzxRHHuWV9fk/NZqa1c+7tD1E5j6sRS8Ru73zkcC8iUrN7jS4KqxoKpU0ohoC4zCVg14h2h0MBCPA9cq/1NiANPWp3wXE wF+QgXVxByrVmzgjoSnQTNAXDAJXg0XwbwISzbcR7wky9CecZ8181BUYhZIZxj/U9WyqYy6gUtuP vLOqIAlMoiEXZQaDfIaY6bgXsObj+mZcM5OFGm/h2ZnGwBNOn6KYUKwudPelYr5C8a40ahGOOZGS zGYÜG47xEbVTJAo1+1DUpWLd6xwQmJ2p2HiXRlaFeT8Vg5vNJyhFYNyLuPdSU6VuRSPQBvRS/sWG F+1WkLcKiiVbqb0es8V6rJMPbQwdDnqDYWA8uBH+9UC8eR3iTSLSJzmPmRbSAr1CcrtRja+NGGpp1qFiuy/CdlbBg+BzGnFRDjJ2a/Tlc8gXmPvhlwxlRgo1rqMMhQbsoPtGSgARShPMDXTbJdOBEuwS ahGOaaLed1H0BdxLPRXxUn+nPmF0qsJPYrdjzBxaYORRX0W3kOu+rvkggvra1RnEzTHfBKUghwaY Lup/KeiLqb69jepHRlJ9c3fI9XVh3ByG8rdfDOOtMJR/pfgDqX7EP0Py/vF8mBWvyKL6rjFUH/08 IRz5rBeywMxxVpkFzmntD5qi/eHMgTaAjgWdwGwwDcyEfwRYYBo0xexK0/Vo5wvFNGMv61wh4oC2wwfNgMv61wh4oC2+kvpvfSGFGcU0AL7FnGvSovVesZZJnUq2uNijGTszbLtAvnk6J/RAsb5DXqVcOX1YxwHSqG39TFj CvSbiv0119SNA6KeUYMViDnn20rDSqK6rBDS7NFDOuWGMqcJPYrxN8dYp8oRjPI2x6R28G+G0 piyFIXU4TcC70sJ4nlbor1NH/SSN1D0pM7Srvp06au9TQ30FxqKzNFKbR40125x9+hZcz8ZYMBVx T4OT1EWmE2kI2pW6a2eQDmn0x9H3EsitrwNPo066Yuy7FuPZbWC1mLUr/OA7feIFfgeMjmgPjH3G I9LvITAuzG8ZGK9VwH0PWAKWSf8pYKKRC3cNMA0slv53gmlGY7j7gOnS7zEwz4iDuyFoKv3Wg1X6 KpTn32Ct9DsA9uuwMfRt4AXE/Q72Rh2QJcNh01TU0BALfZmkHhD+5zIE+jSaAM3Xi6W00HW6Vm8Z sFecGcIGQZ1KzVXUgm0I/0oxp7G94J8n5ma2F/wPwDYYLO2ALdQgMN8bx2kgz+FODZFGzNvGNuov 5mCeL/0DhdqoOzGf2rPpBszz/awZ/t+D86KYC2thnK9OScG5DGNrcN46RSN43oLtEusMlfNRItUM ${\tt zDvGA3RVcC5ZwfOHMY8GyfkgZOy2XkEZMK5bn9F081vEFWzCmCoYjfd0KA01XkO5UXPGOozZQP+R000GA3RVcC5ZwfOHMY8GyfkgZOy2XkEZMK5bn9F081vEFWzCmCoYjfd0KA01XkO5UXPGOozZQP+R000GA3RVcC5ZwfOHMY8GyfkgZOy2XkEZMK5bn9F081vEFWzCmCoYjfd0KA01XkO5UXPGOozZQP+R000GA3RVcC5ZwfOHMY8GyfkgZOy2XkEZMK5bn9F081vEFWzCmCoYjfd0KA01XkO5UXPGOozZQP+R000GA3RVcC5ZwfOHMY8GyfkgZOy2XkEZMK5bn9F081vEFWzCmCoYjfd0KA01XkO5UXPGOozZQP+R000GA3RVcC5ZwfOHMY8GyfkgZOy2XkEZMK5bn9F081vEFWzCmCoYjfd0KA01XkO5UXPGOozZQP+R000GA3RVcC5ZwfOHMY8GyfkgZOy2XkEZMK5bn9F081vEFWzCmCoYjfd0KA01XkO5UXPGOozZQP+R000GA3RVcC5ZwfOHMY8GyfkgZOy2XkEZMK5bn9F081vEFWzCmCoYjfd0KA01XkO5UXPGOozZQP+R000GA3RVcC5ZwfOHMY8GyfkgZOy2XkEZMK5bn9F081vEFWzCmCoYjfd0KA01XkO5UXPGOozZQP+R000GA3RVcC5WA01XkO5UXPGOozZQP+R000GA3RVcC5WA01XkO5UXPGOozZQP+R000GA3RVcC5WA01XkO5UXPGOozZQP+R000GA3RVcC5WA01XkO5UXPGOozZQP+R000GA3RVcC5WA01XkO5UXPGOOZXQP+R000GA3RVcC5WA01XkO5UXPGOOZXQP+R000GA3RVcC5WA01XkO5UXPGOOZXQP+R000C5WA01XkO$ 0 va+L5 CMgjlyL516f5oLSO/vzAeN5LhyEHlj/DB2oK/XwbyQSJnBMeFf5DZ70jjzaso2euM9b0q6OZZmKWaCZtZDlA4y0b8ircM029oMGxDod8q2NI0Tsq076klpfpAOeG9iabhAtucMuke25/WKuWijBADeG9iabhAtucMuke25/WKuWijQooKsRkH2Ouoq/EF9bQ6IUyh7MFBwtYL2FtWBEW5Lqco2c5oV1fLEDsuittZ2KkB28ssoAjJ9xgX 3uG2hq1ZarkQ7x4a6GqFPCZLezbGHgu/aWAw6mYwDXYNxvVDl1b51caqARogvegXDWmx7BtJiq5o 7xf1HBywhxLR1lfg3etv+hCmUDbOMGG/mDHwExSQ1fvLCmWT7AUPqr4i7K6AHfEp1RWgvRug/LK/OH8Um/eBtpRrwy6y18186117ofWR/hCNNn6G/bJYxulv1lAjxG+EeiQ7A/edijiY/1FnJPvWSYzr nyqOiznImWauxXg15ruQOdz6HvbdZOpqzkLfm0VFQtUcOFvMayIfAWyYOLsj1bJe4H5sj1RzVT+Q LeefuUGb08wziR0p5rrq2HwabXYtpYux21yI+AMQdoTa2AnIawjcN6BP1v09jIVo70XU37ZxXQE7 aZpzWszNZm+qafwLz6ZAX/2nQH+EDoFHBMYLNBMME5hR5EX77AH3G2NomjGCstBudWWf7kCrdQ/N t8roJvhNkf5K0UbjlJ0nVfkl6FuR31ZaF1D0qzzwYECNItKNXpibdmlFRoV2B9wN4e4BG6CbwKhw TgpcPenWUOB3Gs+5NPjOLUA5FlCBvpxWgqswJ3UEk/Q8mgbG6jfQEjD+r+IZwm6uoHxQAK4036Kh aLOrcJ0Iumj7MbfeQnMtjP/WbKKI3kSuNiCT1X6aHhVgrJxkbae21j6MEa+hziuwVnmRusPfjet+ 0KGmlwbgeh3IhFtcj0W/qIPrRsbX1MpYhfn3T7zDq2g4sOw01CViDMaKCmro6oW+3IkaoF800vfD XvsN8Y5TBsb/ROMHrFHTMX9vplQzjQbiug/y7AKWAi8YARqAfDAc5IIeIB192Ks/jbpfTbnG7Vi/ foT3uISuMXaT17iGko2PMT59iXFyFezoVaiLVTQEDAOivIUgC/QBnQUX1C/zksvXtKryGanoExY1 Op+nnroP9sgx8ujllKEfhA23klrD3R3XHfW96DfvS1slR9tJAOGf/yYt5vVUpE3Wi6iNPgvprsdc rHSH80M6b403An4h80sb04X6cjkvgn0M9cf801DMMefXNM5v4EPwC19TX6xBqiSwNrBaX8AYoaHr AbmenYD3N7g34hwB25UeUX6/gt8Uvwi/EPuQjHudteBWpYB6Yz5oCBaG7C/0BPWVdhZ+111VE9gT Abmentably gathwebs/ordow/gutowi/setuy/inducesmpisot250cba/c/bbrwuniariivb/ga segqutsWPM/vRJ/7i36118Zggocb7yBlh47yAMXU7gAdpSazpxNwl1q2ha/LQdbdRm+oZUTHFiMd7 NoXm6C+BJXDfhHfsWpqj+eC2qJl+Agq3+TDCRPhjsJlPsBrVELYY440PY+Mcmi7yNB9DmrexvtpA NfXRlaAbs0KAdyGGwbwPjK2oZ0FMZcQaQqA5lcGc7wj09ZgTmYcE2m7EX0+3VGIh1hYLabLR1PlJ vx91j/vCPw7UlustQZy6plhnifWTn1/BPexH5P8KwBo/d4bxN2f0PSNQ941D/rdC6wDhJuNhBnHOKSJDCcbDvUQ9igci3DMcU6M4U9P6iNwC6cR9BcH6Yv+3BMav9FYgPLBeg/9qo4xuC6R3jaLugMLo ZX8IG+DDSn5p2tfklhympgL6klIFuouaSCKpk0BbiTETwM8jicT6GRiRmEuBdg31kAy1WM12siWvU4TAuAzzcwhEzhKs18hsoIh3DkoaUHQlNMcJRdwjUEeiLiwv+r1YuzyAemxHV5hfY00j9r0PS/9u GE+vxvwlBHFHGBucT62ZmDc2od9OwLplItU0x2Ft0RBjZhbCxLg6GekT5X5WqbEH9irWo1i71Zf7 wmLtKfZ8x6t93J+wVvuVsjH3D4rYT6URXajUbo73FesT109gCN5bjPdYH2XIcbuq/e0QfX2rOe+3

w06aGRjncQ+K2MF5izBXHPI8xOMC1uDHeD5xdom9fKyzN+Beo5Cum0hr3uy8jueYg/t0EfcS5ZVr QcgZQWnYGUGv/+R8QJwDhJ4FyP1/dQYQsuffzrgPNutBqoVle025VsYzm0/hvifRFt2xZtuANdYP 8FtCzeX+3zXOWeNFtZebIfZmnT/t6bw3KPY09JuxnjkImwNu2Gty3xBr3WzYi3LfzxT7k2LP7BPU SXKQT31cM1FXjpspysRF/M61oQFcr6uar/OBfssZA/an0Xs13uue2GPq3reWid5M9qZIvJVe7HI
19nCNoPzHdsG/jlinxV2wM8iDWzMWfpnqIMcvPtiT3AdXQ7NxfubYzZGnl1R5oDNEbZPKmwAfQ3m qwo8/x680yspx16Fexc638o1qnjeeXj3z8LOzSdLIOrPiEBb/IY2vJ86CFveSIZN3YiWG/toufkc 5hqsN+U9Q/Zxxbq3yr3lynvmfqP75oHnVlxr5mDcypHr9A6KSSH7yViPOwy1ByOoFGvrAGH7yRfu ISt/tT88E1RDvZ45vz8sMYTKPWCJs1+g2neg0pGBfdnQvVm5HxvYk21NmtqDjZD3fNNZK+OIMNSZ $\label{local-problem} XhP3EH37d2qgn3YeNBejbK3wjD2Q5gTGmLFY0/xMlxmD0E+Xo++cQpuIPZoWsMvepTSzOcqwiupbg6V/b9hjheaHGLOXwXbxOh/h3fIibpw+R5wfYdyzqNi+j24xdyIMdpndBDbYK0jLZz1Zcg8Ptrg8$ 0/mW7TPjtDqDKUFfKEHet1PvCIOKI+7Fe/gc8quLsWMPFbsm4v2DvajHOn3M9edtu0oEzuRGOQeC Z2UW2kTZjsifAnmLMBv5m6vV2VYfZwfbo85K1GegHusvx72KkC5Spk92HsZzTDI3OH/Icq08cu9J 2H821kZif1PZs+HnYcK+1GHv0nBd7DGL/Y521NbsTInIi8SZFdLVk/tbT8tzMjJ20b/LtXI7rP/a $0 \\ GrcY7W5jsaJPZbAHqtiTsgZYyWQZ3PQGgwRe2sgO+RMsTiESKF43p5gROB8MOSMkEAzkCj23AJccD4Y/tyBs7/z536jws79WhrXOX+EnPkl/O2ZH+op9HxP7uUFzvXupRrqHK+z3DO+kaJEnEDdy3ofAyfyBrady2DAyfyBrad$ 4axAeUiUwUoVbY549yEN+jrqZZAZBb+FsDMEbygN2PHiehljv6D4VGnAvhfXH/L5HNrxouc5rssu 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Dr66ijqinrsjfG7ftYhxbAfo8zrocjDWkMz0M715HqwLsop1pmX4b0PrDNfwvt/sXVmqVprnqYBcr0p1ppqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ8649M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXmOJsbwPmlpPoYy3VOZ864M3Umv9RrTnDWAF1RPnf0KMr9L5XiZdrh+CHuKzBr0p1pqnSnXm0JsbwPmlpPoYy3VOZ864M3Umv9RrTnDWAF1RPnf0KM7NDM3Umv9RvuD53hd41q18zqc/Cb/fcL0A/fJL6mR8gPF4G6XK/MS5oDoPDMY5hvpUcexH0G+/puoYf3KMV1TdNZPirKFYh7xKLmMC7K4e4ChoByqAsJtaOTi0W0cb76Q+FX1/JdVG22nmAdiEeGdkn3+GcvS1mAtf 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$\label{lem:problem} $$ VPzAnNuiKFFcpbiaqdgexgzQXaEpBilqK6or+jPnXoB+wHVRcQo6QBFo81SmYpciUL/limWqfR9XhPqLb8VXKTqHEfD/t+p7ffi+FWvCWKfaa70iLB/RV2R/WXU+zTlLUY2pyBDgHS7EuiBKkSjO9y/4$. $$ VPXANNuiKFfcpbiaqdgexgzQXaEpBilqK6or+jPnXoB+wHVRcQo6QBFo81SmYpciUL/limWqfR9XhPqLb8VXKTqHEfD/t+p7ffi+FWvCWKfaa70iLB/RV2R/WXU+zTlLUY2pyBDgHS7EuiBKkSjO9y/4$. $$ VPXANNuiKFfcpbiaqdgexgzQXaEpBilqK6or+jPnXoB+wHVRcQo6QBFo81SmYpciUL/limWqfR9XhPqLb8VXKTqHEfD/t+p7ffi+FWvCWKfaa70iLB/RV2R/WXU+zTlLUY2pyBDgHS7EuiBKkSjO9y/4$. $$ VPXANNuiKFfcpbiaqdgexgzQXaEpBilqK6or+jPnXoB+wHVRcQo6QBFo81SmYpciUL/limWqfR9XhPqLb8VXKTqHEfD/t+p7ffi+FWvCWKfaa70iLB/RV2R/WXU+zTlLUY2pyBDgHS7EuiBKkSjO9y/4$. $$ VPXANNuiKFfcpbiaqdexgzQXaEpBilqK6or+jPnXoB+wHVRcQo6QBFo81SmYpciUL/limWqfR9XhPqLb8VXKTqHEfD/t+p7ffi+FWvCWKfaa70iLB/RV2R/WXU+zTlLUY2pyBDgHS7EuiBKkSjO9y/4$. $$ VPXANNuiKffcpbiaqdexgzQXaEpBilqK6or+jPnXoB+wHVRcQo6QBFo81SmYpciUL/limWqfR9XhPqLb8VXKTqHEfD/t+p7ffi+FWvCWKfaa70iLB/RV2R/WXU+zTlLUY2pyBDgHS7EuiBKkSjO9y/4$. $$ 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O9wI8WjNtUOVFitTNgymbYoY9UPittTaadfj/620tloyrg/O0mgdtC5aN/i0gbs93N0R1k5gKg21 fJpOZ6zD+vvIvy5GlbKUzKvHjxs7ZnSOd+SI4cOyhw4ZPOjKrIED+vfLzEhPS+2b0qd3r549unfr 2qVzp+S2bVq3SEps7mnWtEHdWjE1q1eLioxw2RYmIY1aZ3gyc92+pFyfmeTp37+NcHvy4JEX4pHrc8Mrs3IcnztXRnNXjpmCmJPCYqZwzJRgTC3G3ZN6tmntzvC4fTvTPe4t2uhsL65L0z05bt9ReTlIXptJ01EdjoQEpHBnNJic7vZpua4MX+acySUZuenIr6xaVJonbWJUm9ZUF1UN19Vw5WvhKSrTWvTW 5IXeIqN7Gabg6uK2PiMxI2+Cb2i2NyM9LiEhR/pRmszLZ6f5XDIv9xRRzrrTXdZ6a8k/t8RQfm6r 6AmeCXljvT4jD41KjIySktt9tVr5WnrSfS3nH2iAR57oa+1Jz/C18iCzrGHBG2g+KzHG4y45SSi8 5+iRyj55ysdOjDlJ41I8YrCaEB64JpQNJcTzJSSIsty5JYXy4fAtzvay2035ceWUktwqx6fnipCt gZB6I0XI4kBIMHmuJ0E0VUau+jdncgPf4nx3m9aoffkvEf8Q7vYZSbn5BZ0F5k0s8aSnc72N8PpS OnGRkqeeNaOsXTLi5+XiIaaIasj2+pI9Rb66nlSOAA+3aIMpw70yiUrmq5vmgw2oUvmSM9JFudwZ JbnpXECRlyfb+wJlcL4t6+iOe7oDdaQcUQ5fbBoaJSmjxDthkq9pbtwE9M9Jbm9cgi8lB9WX4/FO zBGt5InxtfwWt0uQd5Sp8GxhsQORxZO7EiPcXj3OyBGtBQ93Jv7nSe2JgBg013SKFk3t6fZqcRSIhruoGOKqUj5wGIlp/UWQIZKm9Y9LyEngv78pUpwqk5XoiwjJKwYewTLxff6yaBxbFKilO2NiekgB 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0AjpRb9oTEtk30hQdEd7Pyfn4IA9FI+2vALv3kDThzCFsnGGC/vFjIafII8M2V8eUDbJHnCP6ivC $\label{eq:condition} 7 \texttt{grYEZ9RfQHauxHKL/sL+kexeTdoT9k27CJ71cyngbUH2hDpD9144xfYL0tknIFmCTVB/CaoR7LTcN/piIP5H3VGsm+dxLj+meKYmIOcQnMDxisx34XM4dYPsO+mUndzNvrebCoSqubAOWJeE/kIYMPU}$ tTtTbetZ7sf2aDVXDQCZcv6ZF7Q5xDwTT5FirguOzafRZtdQqhi7zUWIfyXCDlM7Ow55DYX7evTJcr6XsQjtvZgG2jauK2AnFTqnxdxs9qVaxsN4NgX66r8E+v10ENwvMJ6lWWC4wIwiL9pnN1hmjKdC YyRloN3qyz7didbpHlpgldGN8Jsm/ZWijSYoO0+q8ovTtyG/bbQxoOhXOeCegBpFpBt9MDftlIqMCul2uBvD3Qs2QA+BUeGcFLh60y2hw080nnNl8JlbiHIspDx9NaOBozAndQZT9BwqBAX69bQcTPyr eIawmysoF+SBq8y3aRjabBSu40E3bR/m1ptpnoXx35pDFNGXyNWOT6mF2k/QgwKM1VOs16m9tRdj xCuo8wqsVZ6jnvB343oAdJjppStxvRGkwy2uC9Av6uG6ifENtTHWYv79E+/wWhoBLLsTdYsYj7Gighq7+qAvd6FG6JeD9X2w135HvGOUhvE/3vgRa9RUzN+vUrKZQoNw3Q95dgMrgReMB11ALhgBskEv kIO+7NWfQN2vo2zjNqxfP8Z7XEJXG7vIa1xNicYnGJ++wji5Fnb0WtTfWhoKhgNR3nyQAfqBroIL ypd+yeVrXlX5jGT0CYua6M9Qb90He+QoefRyStMPwIZbQ23h7onrzvoe9JsPpK2Spe2gQaDff5MW 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$\verb|Enmp0K6mXpJhFCN5nWzJaxQhMC7D/BwCkbMc6yUyGylinQOSRlStEprjhCLuEagjUReWF/lerFlWoB470BXmllj7iH3vQ9K/B8bTMZi/hiLuSGOz85klC/PGi+i3k7BumUylzAlYWzTGmJmBMDGuTkX60xBKMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBKMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlYWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlWzTGmJmBMDGuTkX60xBMC1/PGi+i3k7BumUylxAlWzTGmJmBMDGuThyAlYWzTGmJmBMDGuThyAlWzTGmJmBMDGuThyAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxAlWylxA$ eLmfVWrshr2K9SjWbg3lvrBYe4o934lqH/dnrNV+o0zM/YMj9lFpRDcqtVvifcX6xPUzGIr3FuM9 lkdpctyuav84ZF/fasn77bCTZgXGedyDIt7kvEWYqy7yPMjjAtbgR3k+cXaKvXysszfjXm0RrodI a97kvIbnmIv7dBP3EuWVa3MP0nbDnHyEOgTmo/DbRc4RezEfZjpfwNaqZUY5j8027GGuw1p4PNUU 63jjsLNMf50MrLuGmGvg9wy55P0Is4kAoecRIeCe8xU3g95gcfD8IXDewNQTiufCvOgsDJwlhJwn dAK5YJJYbwa44Cwh/PnUOUHIGUFp2BlBn//kfECcA4SeBcj9f3UGELLn38G4GzbrAaqNdXstuVbG j6t53tiIebOaM03kq/Zika+zlW0G53u2Dfy7xT4r71BfRBrYmLP1z1EHWXj3xZ⁷gRrocmo33N8ts ijy7o8wBmyNsn1TYAPp6zFcVeP7deHfWUJa9FvfOd76Ta1TxvPPx7p+FnZtLlkDUnxGBtvgdbbiM Oglb3kiErd2EVht7abX5N0YarDf1PUP2ccW6t8q95cp75v0D++aB5ldcY2Zh3MqS6/R0iikh+81Y j9NMtQctyBdr6wBh+8kX7iErf7U/PAtUR72e0b8/LDGEyj1gibNPoNp3kNLRgX3Z0L1ZuR8b2JNt S5rag42Q93zL2SDjiDDUmV4L9xB9+zg10k8795hLULY2eMZeSIMCY0wBljS,0GXGYPTT1eg7p9Am Yo+mFeyy9yjFblkyrKWG1hDp3xf2WL75EcbsVbBdvM7HeLe8iFtXnyvOjzDuWVRs3003mzsQBrvM bgYb7CWk5bOeDLmHB1tcnul8x/aZcVqdwZSgL5Qg79uob4RBxRFL8R4+jfzqY+zYTcWuyXj/YC/q MU4/c9N5264SgTO5sc7+4FmZhTZRtiPyp0DeIsxG/uY6dbbVz3mT7VFnDcozSI/xl+NeRUgXKdMn OvfhOaaYm50/ZLlRXrn3JOw/G2sjsb+p7Nnw8zBhX8qw92iELvaYxX5HB2pvdqV45EXizArpGsj9 rsfkORkZO53jcq3cAeu/drQ091hnbqQJYo81sMeqmBtyx1gJ5NkStAVDxd4ayAw5Uyw0IVIonrc3GBk4Hww5IyTQAsSLPbcAF5wPhj934Ozv/Lnf2LBzv9bGtc4fIWd+cX975od6Cj3fk3t5gXO9pVRT neN11XvGN1CUiBOoe1nvI50HUB4SZbCSRZsj3t1Ig76OehlsRsFvEewMwRtKA3a8uF7F2M8qPlMa sO/F9Ud8Pod2vOh5juuyi5/h4N1dIMe2K7EGEmMf3lljiRr/8uSYly2wmuOdnEgpcn9xCOiC8Xwk RZvjEWegpL/xCdU2voUfjy8L5JgxjWIkA2meOEeDHVjH6Ep1dBNxHpdj3jyFOLfbIce3yWAA1ojb wGOULva6Mc41keyVyuPfOpoHYo2fkK8AY572i7Ndz3R+kbrWeRLjX1eQZJbBtnmChp19aXZgvJPj 2DNUA+URc2WGmI+MJwFsHtBfKuYCqw36t9g37YIxbATqZhzuvd55CmN5Y6MnCfskK5DGfgbz0jnK co2hLKsZ2sGm+tZazFf5aLMTNN98FfE70F/+SqPMcRjHxoPLMKZc73yBuTYbfSfKeAnvWZ76Sj7qMxd9CHWOupuqF+J++/G+nCG33LsV+7wbaBTip5s16F930GCrBUXYr9Iw44Xz5wnGl3L92BEUGyPR x4sxhl6LuN8jzj0YcyPRr3qgn89AXx1L3VGPfTF+18Y6pBj2Y5R5HRR5W0tpJtq5gVwPlkc5xTrz Mrz3gXXm83j/L7b0LFVrzdN0pVxvirWmWmfKNaY429uMueUk+lhrdc6nzvj0LdRWvwHteT14gBqI cz5xxlfpfC+dLtcPQg/yWV/wf09LPOt0PufTH4Pf77heiH75FXUxPsR4vJ2SZX7iXFCdBwbjHEV9 qjj2/ei331ANjD9ZRhuq4ZpFda1hW1e8TC5jEuyuXuA1aAOKgLCb2tAEtFtnG++kPh19fw3VQdtp5n7YhHhnZJ9/krL0DZgLn8W7NA39qx/NsmEvYP4IzPezMC8PMKY722FTxpptMUcPowxzC2yXj5Bm KqhFA/Hu8jtai7L1OTRNvM/iXTDfxlx/J6XoP9BgeW46A3yLOrqeOoqzU22bczZ4fvoHldXKaRjq Y6z2J+Zf8YnTy7h+msbq/THGTuc6N7CeB6ONZpg3UPfG88ivO+yrKIrW66CvjsL71Y766j/TMPOA 2KbOVR8E74KHYfvGokxnuc71mS3qXzuFNWg0eAb3iePzWO0N2Pxp6B/n9/enBtbE+mrU3WoaH9hT RH21F+jZCBPnteIcV5vxXgauhV832H7deJ+hvr2GTZgXN9EKECvOkOVzibNhcZ8YWhWOOaov8EuD hXJ4SC+0MRw4N8IegHwT4VWRXg5/ipe6t+Uoyr/J0gF/Lf1+Jt8PdAL+JvyZUGr41LL8Vf13Bx6/ $\label{local-potential-p$ vb+9yh1K3TDC8hF7fwK51hffPV6FcS6gyVijJPszhco9BRFnGtbtr8qldjTm3CFy7T8QdsxKzIkrqSfGztrmHkqy38Tc3J1yzd7OMXnmKWwg1rbWQ5jTlmPMF/PoDuTzC8bjD2Az9MPap5rzJdbqj5sH 0Gf3YN7j7/FS1PaCvRdvRvk7CJV28Rso0whqb43A9WzqArtK2rDmXmeludc/GCSBo3A/CM0B7cAR uIeCpMpnCjKNV8U5qtzBNPZ62BzrnZX2er8XtANHlTtHuY8Yh/wvmj/5Z4PpIdfTcH0NGGdF+1+0 a/png0Jrh39XmPt9uCeDserbj0DYdITtDH0/b2/HOmu7/0XXm/7ZYLprgX9nmPt9vZn/RSPRPxsU 61/7d1ZyN5Ph14Bxge9OrSn+fXZn3KOzPlVdzwLpuL4fjDdT8Uwt/PnWMv9s8IC1zPHATaBx4DzE mulYdm//MjDaOu7/1Jrpr1DuMdYZ/ydw14H5/A2KjHsjGIqw3fD/DdeLlHuXK50GuNIdKyLGfyMY 6nrfv9uV7v8N14uUe1fw+5H/IYFvUUBGyHWQ4PcpF2fcfxBXxoedX00f6BSDW8B0uKOUWzAF1FXkg1/BDaC9Cpt80e/lxHcxgvPfw/wVESAyzG84+Ie4Dnwv87/gP/m+9z/Bjgaxf48668oRZ1tVXF8b ti7/r7EHgpy/B7ZaItb9d4KZ6pvhRiHuIlADlATXIywSug6kgkki/sW+Bw7sA8i1uBhr/8ca/Bbs /wh7FVj391zKmH8p4/AF49hMf79K49hMf+alzB2XMp5fyngYbnvIc7ZQOyPUtgixJ4L2A+wEvT2t 0X49j7UE8/ydVFN+W3g7xvlrqdTViL9jwxq81Hxa7s/FWK1gH+Sjzj5CuBfaj+2K898igj2UYFtw v0eDxHdpoNTuRfEC8R2c+D70FPaGF2t4Uf/j1Pdrg/gcKHD0YxyiDHEmJVDfIFWTZz0B7+pCzymGwJ4IfB8nQH5Y05WK7+Dk8+wgtzxnKKQW9h3U0yZqaXamlq4YihJnRVYS2rgORYvzLysdY8dzGJtdcl9moWFTjPEYLbR7q2/FxNqzB6iPfEsRZyWuT9JC6wT0FvWdeROKNHYjHTB13PsgxtXesGltyULL oljJD9TOjJHff9Ulx0IfBIhjfUclRV0Zx6168EzBRZ2CeOvyuzXnnDwP4G/XKu17G4ucs5W+DT5M SeJbOPmNmXgeP+9ZizOruwdlWbPocsS73G5HdelRyGsc8rkNzzAVtv4M1020/A6P5JiR4DjoJ8V2 M/VdoNjz7C2/ASRzI8XBliu2uiH8Lvh9qGy8kO9EMeclWUNgP07Es7QHYxH/O3ILxHeF4ntDMwVp ${\tt N5Ehx8yD6rvAFXJ/MPgbD4zNg9GuQwXqG0VD7gEHv1MMfIMo7MyDGIvUd4fy28P2NFh87yi+L4SS}$ OYb3LfGMXa0KsBiPVZ8G2h3JsIukHeo1i/EMgzAfLke5iCgCBFR/CoifKY2EXw259idtNYX8gMn5 CiSqb6Kai7MUw++cFmty8Z2d9jy1EGt1801QTgeNCueMfjd1x/s2FPUlf69kPIe+VINyxb6fdQu5 XWPRv+PwHq6mlnYTrGlupNriPYz4BePtAuea+RLa9zsaYJ5BnpfhvshDfH9mJ1BHay4dtNaI+9Bw 10Yvy+/khml7zGH0qk1YG5H2Ch04dk65alEJ+kUfeV5ZA/oo+q8X6VxUQ+xHmt3QZ1o5FcZY6mTs i36P+EYqDbBfx3t/Sv6eJgpjRrEljK5wEfrGP9HXxLfNRdQoYj7iXIa55XVG9usdc126G/UxhtvYny1+q6bn0CPaDrT/fLRbtJMVtY6eMT+15fqndIsA1+XQIuF/MYgq+nMf0lc/0JsC31YE14nNK7v1 ngi-qoomocrati/limcoomocrateriin/liqualishi/aglum/nigqinin/ole/dossiliinin/niquin/ole/dossiliinin/niquin/ole/dossiliinin/niquin/ole/dossiliinin/niquin/ole/dossiliinin/ole/dos o8gQvz01Q8RHrVeUQGeo+/2muAes5ntIisC/VfmSxW8omHPDOb7M57j4fYRikvhdBvha0ZafQ5RF51WkfqMxTV3/A2RynVYcBYdUmTPUbzE2cL7n1gKMohVn+d6SVMXCkPsLloLhYSxXvy05N8TvNaSd qMhXHFRkKwoUi8GiEP+pTMWPzLmtihLFKMUYpuL1MGaCngpNMVhRR1FDMZA59yz0Q66Li1PQKxWBNk9mKnYqAvVbrli12vcRrai/+FZ8raJrGaH/f6u+14/vW7E+j12qvTYpwvIRfUX217Xn05yzFNWZ ijQB3uF8rAuiFPHifP+CbwfUd3qXMkb+L8FcIua7BtSR6pVFGlv00+XxTZpu0f8sj28F+aM8vjXk FMtJlhMcdpxdv7P8xnKM5VeWXzjmUZYj7Pkzy08sP7IcZjnEcpDlB5YD5fGRkO/ZtZ/lu/ImtSHf

ljdpCPmmvEkyZB/L1yxfsXzJUb5g116Wz1n2sHzG8inLJywfs3zE8iHLByy7WXZxIXayvM/yHsu7 $\label{thm:cond} fnt300bbLDtY3mJ5k+Un1tdZtrNsY9nK8hrn+SrLK+z5MstLLC+yvMCyheV51udYnmV5huVp1nKWsvLG7SE+1qfKG3eAPMnyBMtmlsdZNpU3vgKykWUDp3uM5VGWR1jWs/yb5WF0/hDLOpa1LA+yrGF5WF0/hDLOpa1A+yrGF5WF0/hDLOpa1A+yrGF5WF0/hDLOpa1A+yrGF5WF0/hDLOpa1A+yrGF5WF0/hDLOpa1A+yrGF5WF0/hDLOpa1A+yrGF5WF0/hDLOpa1A+yrGF5W$ gLO+n+U+Tr6a5V6WelhWsfyL061kWcGynGUZy90sSlnu4qxLOfk/We5kKWG5g2UJJ7idpZjlNpZb WW5hubk8riPkJpbFLItYFrIsYLmR5QaW+SzzWOayXM8yh+U6ltksslhmsvyDpYjl2vJGnSAzWApZ prNMY5nKMoVlMss1LJNYJrJMYClgyWfJY81luZplPMs4lrEsY1hGs+SUN+wC8bKMYrmKZSTLCJbh LMNYslmGsgxhGcwyiOVKliyWgSwDWPqz9GPJZMlgSWdJY0ll6cuSwtKHpTdLL5aeLD1YurN0K2/0 DdKVpQtLZ5Z0LB1Z0rC0Z7mCpZ0UQytv0BauZPZsy9KGpTVLK5bLWVqytGC5jCWJJbG8fg9IcxZP eX3RoZuV1+80SWBPN0tTlniWJiyNWeJYGrE0ZGnAUp81lqUe36Eu36E0e9ZmgcUSw1KTpQZLdZZolmosUSyRnGcEi4s9bRaLxWQxWHQWjYWkaA6Ln+UcSwXLWZYzLKdZ/mT5Q95W0yWfSDvJnidYjrP8 ${\tt zvIbygGWX11+YTnKcoT1Z5afWH5kOcxyi0938DzWA/mB5UB5LDqY9j3L/vLYrpDvWL4tj02DfFMemw7Zx/I1y1f1sRmQL8tjMyFfsOx1+Zyz3sPyGWf2KWf2CcvHLB9xZh9yug9YdrPsYtnJ8j7Le5zu}$ Xc76HZa3ufA7WN71+71ZHpsKeYMTvM432s613saZbWV5jeVV1ldYXmZ5ieVFzvoFznoLZ/08Z/0c y7Msz/CNnmYpZynj2/pYnmJ5krN+gmUzy+Msm1g2/j/2vQT0jeLMt6q7JY26W9fovm9pRpqRNNJc mrM9tsdz3/I9vjHmHGN7bGwwOIQjEAyEywkETLiSrJNgxsYesAMs+MEm4JAFP5LAEszitxtYJhDC dDtpOrdIzdtIzVsJ3TK17wXaSWreTOibhG4aOSOEunFEtwjGGyO6pUA3jOgGga4fObUBXTeiWwJ0Lfnu66TmNaTK14THgD9SzXV+qGxxHue7nM8B/hHwLOAZbr5zBPA4YC/gMcBPAD8G/AiwB/APgB8C fgD4PuBRwCOAhwEPAR4EfA/wAGA34H52nfMewHcA3wbsAtwNuAtwJ+AOwO2AbwFuk69z3gq4BbAT cDNqlpw6RZ1E85GT+hR4HXLiq0e04nS8aqRQVK1NhDaOaETV2kDoMkLrCQ0RupTQJYQuJnQRoQsJ $1 {
m RGqHVGLVEMoSaiaUBWhSkIVhMoJJQjFR1SinpYRihEqJKQhpCakIqQkpBiBQRnFPCGOEEtITqiA}$ kGxEIO61VFqC/HvAGOADwH8A3qe8B8P5NuC3qLcA/wJ4E/AG4DcwLL8G/ArwNOCnqMOAO4CnAPfB UHwXMIp3EElvG9GIKr+VCOdyQlsIbSY0TGg2oSYih1mEBEKNhBoI1ZMu6wnpCG1FepKmaWpEcD78 wP8CnAC8C/hXwDswukcBLwNeAvwc8DPAPwFeBLwA+B+AI4DnAaOAgzDiBwBPAPYD9gHuFUefGicy 3k7oSkIXjGggFMLrCJ1PxLKW0HmE1hBaTWgVoZWEVhBaTmgZoUFCSwktIbSY0CJCCwktIDSfUIrQ AKEooQgRdSmhEkJhQiFCxYSKCAUJBQj5ydj4CHkJSQgxhGhCFCFMZiQSHgSeAKQBvwPBvg74n4BjgNcArwL+GfBLwCuAX4CgnwRcR/ud19IR59dxxHlNy47U1/bsSF3dsj111Z7tKW577fb27TS33Qp0 xfY929/cLr2yZVvqij3bUsw23TaK3dqyJXX5ni0pbgvmN7cMpwaGTwx/MkzrhgeG1wxvGr5z+Bhc kD08vH/4yDA90vGstDhcXdu8Y/i2YUoH31NoGKvEy+5hTtm8qWVDau0eDslm0/kGqvaTDfj4BkzFNuCeDss2UFBr3wZfUbNYu2KDwdKs3hDb1GygL2sZSq3fM5TqHhoaunpo99AzQ5Krh24doh6DEiUMyRXN17Zcknr7EowOUxNIDXiWmhih2aFDVBph9CGVFibwRSCAC0EQFOTOT63bc35qbWRN6rw9a1Kr I6tSKyMrUssjg61lewZTSyOLU0v2LE4tiixMLYD68yMDqdSegVR/pDfVt6c31R3pSnXB9c5Ie6pj T3uqLdKSat3TkuppwfMizam5dKUTPAhywL/1jh20jxwMt8K+3K6ttx+3f2Sn19s+s1FXW7HKcrXl VgutggNFDman+VbzbvNjZokqU6D59YU7Cqn1mh0aKqYRNL/UHNcwSPOAh1LdqtqtekxFd6uWqz5U wggtgggrbmani v bzzwi v bzokogowoż to kontinuotakytruk. Omcowsko-nintagicie-kardounycz TaiżxlT4MeUzyleUdLdyuXJISauU4jmtPpSRsmaUwgkQ5kUVdF1U0ajotvCSfxCgiMSbBVUV2NzI d/PLeXo3jwU+UNz8ITvBUgILX3won5BTE3KMaOzCGGE1EF0gjhHW05tBH/cZsARDaPH4QH843D4q m+hr31vQs2Qv/sZef794FHoX75V+Yy9KLV6y8HGMb1n00KZmD+zVtfcuJufX7dyJmuzte+39C/c YF/UvncHFASxMAEFZH/cgJoWhZdtHN64cVN4YxgOgGUb4cqmYfiXIQxH4OFN4jebNiKoEv6Mj1hj o0jDmUobh5cPwz3gC7i8MXNZPFuWqRL+e/hs/O98OP67EMH/lx/T8mVIg1B6I/2mRIloJENJ1Im6 OMBhpMD3ISOqwS/tnzOnoFT2NJxSyIVfQgUI4/sELUMprNZGb4X0ZrpX09oou5kaQI3jv33rBTgc LUxGj+LoW2Ovj6nHX9Ako2PHxspiWOPWZKBTUjKZVOr1RKiKYKAykYg3UBX1Aa9HSWWulVdWNdCJ uIOidbkrDZR4juk3T3XTc8d91FZ3bX+ZBIf9Rqe2oIB2OhT+hEvV3umtLLJImAIpLSmQBSubvKkt bZ5fsKaqzR40scB2G/D4cxLlyY8lyk8XMHM+PUZ9LrmwwSfdquAoibzqviKH3ldmq29XgBQSpdVo sckKNEo21LJy/DsWv5FljX6LzS/eyz9eCxIxTpxknpfokAcF0Dui2UktfBL5Jn63n1PhDu/ox08E Gbcg7ZYpaa8nEKiswmSwjDIv7WYe56WG6rJE0sEzC9KWPkZhrwhHynVSHt8qVXsbErXNQY30OXwQ D63yhfQSWq5WYGZcqeUYqTHkZa7U6Dma5qzaF8bfAH3ciRBTCZrpQGFUjXbn5Ouk7njCwun1HBLX $\tt cksCCXF1k7MEIaDZV1Ym841m0+6DIEiQq3vLTeJZuRguCbIB6CB0KNw4FobujSVxdCweHQM1LUyClubsCCXF1k7MEIaDZV1Ym841m0+6DIEiQq3vLTeJZuRguCbIB6CB0KNw4FobujSVxdCweHQM1LUyClubsCCXF1k7MEIaDZV1Ym841m0+6DIEiQq3vLTeJZuRguCbIB6CB0KNw4FobujSVxdCweHQM1LUyClubsCCXF1k7MEIaDZV1Ym841m0+6DIEiQq3vLTeJZuRguCbIB6CB0KNw4FobujSVxdCweHQM1LUyClubsCCXF1k7MEIaDZV1Ym841m0+6DIEiQq3vLTeJZuRguCbIB6CB0KNw4FobujSVxdCweHQM1LUyClubsCCXF1k7MEIaDZV1Ym841m0+6DIEiQq3vLTeJZuRguCbIB6CB0KNw4FobujSVxdCweHQM1LUyClubsCCXF1k7MEIaDZV1Ym841m0+6DIEiQq3vLTeJZuRguCbIB6CB0KNw4FobujSVxdCweHQM1LUyClubsCCXF1k7MEIaDZV1Ym841m0+6DIEiQq3vLTeJZuRguCbIB6CB0KNw4FobujSVxdCweHQM1LUyClubsCCXF1k7MEIaDZV1Xm2k7MeIaDZv1xm2k7MeIaDZv1xm2k$ klof/5K3KYstAsVmvG5PoEJTXplwq0j0ogY7aFweobxejajm2qkiUxmYPbj+6q70D9ylpW48d8sj 19WZIrPDVYNzi9I/MsVa66+7Izmn1DDbUbO45btPV7VXOfG1c9fPbyjSBkuYdSXBot4rB6L9c8rV $\label{eq:bl27Qvx2sKHYkn5rjta0/710XsySvs1Y01t81aJ74j8YXuKFmf1NIr8RGwo/Tb2IlMieVyI3CmS7GRBjWm0/AwHrwYpYpq8xMegV5PMzfR0PHxtrFA8gsW0gZNbDX/YGICu/TkkMQHlhZSWojlSfneui$ FdDrHJQoIlGtGJ6WsobGJcZrrnv97p6F9791XeWalBwrK6UZVilXRVrPa+7cmiqJLriis3lta1TB8gXMEbPXXGj0uQ19D33y4CMY/WRxoTlgLbQFbI6QhfeGvY3Dj67b8P2LK9xFrgJTWHwJRdS0Z0HT CpETXUbk9AzSUvcihCzU7UiOTN10miAuF+TKXmumf1YxZhck05QBE2MH0+9cf0E0h5qh0ZJpevLs 4E/+/KP0Sxkt6fjxHx6Zn/4ovPyurdfdePGdq8uoe0bGH2gnCtG7+/2H1t6/adap26ov+wGMPPSJ vhn6VIL2kh6Juk3dLqjkWpfWBX2ymBTQIstTuFgcwwMK3BkISM05tTdn2q3oDWbaHRTzEUE6U+3D Yn9h4iSjUbVoIqwHvopbEvWgzphKXrfmtCJ0j1XJxzeLsqGulytZiQSUIh3HN8hVYlklT2/Fr4rl 88EBcERMrDnoADfApY9wRnAMASObvoMzBcW5snPiJL0aJBZET2Y1JtOOUncKBoUdOeyyIhXulJ14 $\label{lem:betagamta} BetagqTkoPoUXIO3ERwegrNWapaMTx/dBDWmmt0rcIYUMcL/g6TVnbKrYxWwHw6LUjmiSGZEJmq/wvpO6NF1SOS+akyV0kQMpLcI75UpOkilv5J3xYCDhUIAcV4pXmQcdxSY+/TBrKnI4iixc2sGpOakU$ DsxdJUHOHCLSYq4G3xdfr+Qsc5Q01z9tsi/LXJbzLCPg/cBeXtxNM/o4IPBKxlCfL6MzvkN4NRIQD+5TJ56reCdP8eCxZviojHMKZ1QHR4+NxdXES4kfqyD/0vfKqV9GZNO1RwySHq7liszVCkc8EEZY FWkb7yASVDgSgWDcweMTCnsiGIg7FD5WzUq1cKC48f/M1ZkXcqW0H7+ZKxOp4rtAqnoUykkVUXc IbDqPtJYHIVmguLsy12Y0eBc0/BdilyDnHGxQVPNmHo0y1qJAXieBbXnnqcHleeQXNWnz0hQL65r TJunOHpUfL7wmRVmTuBJsYmqNwCTkh1/zF2aFZMC74ILkksdxVYepueuXMs+/ZAzF4Nd7p14T2KW +JEW5uSkXdZRz4FddsCRReYp071UWtTvNZGQR2yRZP7Z7PK5/i1316YFoBmzPM1Bscw997/3nV3v3n00fM8d7+zqTH/g6tyxYuU1PW5Xx46VIlN3fy/9+GD3gyf33Pfp3mVdD/7pwNrvb5nVuu2hJRf+ 8PLGlisfEb0PzKROsDuVaA66j/RyvzqiKWYPUS9AT6uoe0eKGzWZneeIOmdM1RCW7BMEY33uQj1E JgcEd68xp9ViR8TgJJwJco6BACCiS4pBzpe7yzRFC9IRGhzUTNNiMDrobMxjNBoMuDwQDARybqyz wFETD8XtPLNJX1QmhPqy+smDW+tONFm7ti+IuIVldfZEaZH2EhWb/nFNky5Ruvn66oFqm4dTsQzD aXjsLutIWNLaSV3eVRJkaK5ywZbOWRcNNGiVRcnWyETAS68RFhZKpOlvWcvmiFreOPEeOAs/akWH clo+i9r1hC/ui/NWMYpEf0QQLkVViMWlBzRV8Geoy4mkbhSXCvwsq6S435BRFoO4jDdNWUCqY2EN cYPqMdEYZXziWCZIinxFt53SRyanjyRzikiz56cHUVL65o5rfrJ69saFtRaOATeoTPOMtcY6Kmyx zlXrVnXG5g7vXhRZ2tOgk0koWqbguFjz0qqwENZHu9esW9MVw9euvef8coPTYymLOEMWzl3kNoYa $\label{local-problem} A \verb|iwNZeFYf| wpt7+DowYjS5NApjV6LvcjC29xwb/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8KMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8KMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brR1r834mBDgs2hrReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brReqYPsyReYOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKXjUfSaNtDAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brReqYPsyReyOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKAyBu1dAnh8kMP7P38pP+L16jR8aPior6F2tNebspe52brReqYPsyReyOnbxKCAedBebOY/chibfbwS58+BR3wfN9qBU1qMiKAyBu1dAnh8kMP7P38pP+L16jR8aPior6F4APior6F$ qi/UF/Ny9GnZFJhtc9R0DJpdmDRHk8nCpE19LFMuTJI5Kag+86fivBOzLXHaeelsCUPuVZlJvLQJ bTYFy5YgS5NJ3pbqQ02J5NyiQskr1BFJYXB2VQ2cSNNvyClzMhGtsrH0u/gDRuGsLI0lnUrmE+pd TYLluAfT2z07PZTg6fGs8NAqj9ND8YZHw9ghehCUPOiE3aTGnfaTkTbRekGKhjvrTwh8J4NM0ZwVDxPXPji4fFC0ftHw4GVjg5eBPTySFGNWIvn/5tZk7KqYWAcCFRXZhRFRhxMVWX+TvcJkHKmMzG5D I15zRW/WhU01xZqqnfPnbVkQq9+6f8sCTXBWrHF1R0LNaTgpa2teN1R7wV0rsv60on5+pX1eY8Wi iFOp1snUynm1Tf7Wi1u6Nrb7KkONIZ3NY1NaAkanz+51aItT1y99o9CXcFcLleVihnTVxHsMkqxH IVSP7860K+uuPEStgFAlTF0ryJGeraxwM5JYbspC9tcukAJtlm21RzJj42LipDUg6cxZuEYx6Dcm RYuZHYwDZ/Ye09x1UH9m0EZmSM6ByzQGQ8YrofJVty4p7Zo31wdT3uEsNrO8Peb3x+y8Z86c1qLV NyOoSn+qCc10mGOJSkfFyoqyOaU6/MGWp69v0QRqildm/BKr4iRelsTHbFrriTmV3dfvG05e2Fem 9FQWpX89Z168Zy3Yk5aJ92k3/TqqyH15yMWDT10DMrm4E1JP39SSg3NE28Y8hVtQGWgjB61AWUmm +yXivp4g78y110HJpPxIPJuU/3V3mpGd5/yKlLgV6fTUHLoikZ1q2hZEzt99cdXsyx9eVdQ5u8Ig 19A6tSZQ3hJftc6S6EyUtlcHFHJexuy1eE0qo9uiFrbv33T98zsawHUYVCavuSYKqrfr9pZL2/z0gJ01hkR9awc78rLkEhRASXRXV1qcNXmIWgYRUZTaILBadzOXDFoZZSinLDBXWwW5qW1ypaZ1v6Ds lHTkPAbRlMZMLEimvvzL3mN60D19zkIQNK10dCAwPVqso19mTcUOV5GZm7tr6dqdi4oSq25f3r6t jsuonI0/Wbm6smxeWF9YPKfcUpaodHly6rW6rQ80arWodvW1+N2cro2Xz2kp6zuvovrC/rjKU1Uk

yq0N5HYA7G8YlWMJkds+rdZdIr6HFi5nRkXJuekSbQllLXmeEU2dEbJ0xKgZqqOHWcFQDzB7GYph $\label{local_bfQ0} bfQ0iJisiSy4oE70RKDN9F9IqVZSGlopN/G4U26CCvI/C7acEoWPgXkby1q6wcsgpxpbNihGn2+Bs4tmJP63fXbGLEi97ml6q5+p3ZQ+WJkZJx19oNg3/o61dnBW05rWmErOF9AUU6CoWbypacu+y2sb$ $\label{eq:nv/wwwW718Y+oZcsj82Imil8M1KSHJz10Rq1skK32eA0qJQmo6Zu21PbtzxzXXPT8APLXBdu9dX3R2HumydOUt+WXA6xxMbsqBjUCELP5ftiIT87iu37KudZAqNTa2nOA0KsxdWhbpmMwuONMM2PJMaP$ JI5kMhn2HH8OzTRm9FFPpCCdHsCD88n5nIxUGOrbTAErlWnMHqM1aOEfEgMmnfYh3hb3+crs3Hqt $\label{eq:sqxxr6im} SqXXr6im/1zXEnKVNB1uolATbjpa3aZagtX0kpcFVzdxFKAbjWODg4XJxoznFZ0wnA6+nqGM/7AKqelP5trw5z986tl1TS83UUwTVv3F5y+basGMBgzmPBgMisFA/FcgKAV7azBms6qcylZBlFBemTkS$ ewOJFy4PTEYF4ipzIBhU0tkz+kGD+gKDtnzljQPhLj2vTUR+07GlN1yz6bHhDd87P6pxx5zhaGXYG6pa9Y2+UKcbWzX69E97Wv3V/sKeeYFqv7a2pXGfxamVnrc02RXT0StiEVO9u2trf1ivVPgMdj9V QPtnL6trGp4f9wmLKtx1VXGjsTtauzLoXdXadUWq1JWXpp/c0mMOJ51zuk2hqvH5pTFKovW6HOp4 uTEQFWPtqyBTeBXiizi6JJehcdTykXhIN0qt2AdB+fSUtVOQC6VtvmZzBzHMuSyV5LkwlCPnVn/m 0knGw8nOsuJDAm09/SpvK/P5y2y81pcMxFZV5GKFHM+6oXXJ9k6PJ6f0eHxWW4W9efb4Y7kr0+ME obFu3TdXizb7oomTeKekCwIpN5qbW+UwUM8qG9JDfMUiJ77iCcGsbiWtfx0aP7WeceZ3Z10Q0oo+ XNQcUBm87fSWaxsGUrX1qYG6ybbT28DvQEuhF7GOmurWjtpkdpQOwSiVo1W5dpZBCz2Ih6MBeakD $LtXZSf/xNui/HjVmrZVKoccQVHEsViDMMQi0VVysayZdyS^7WZWL+Qeu+30WzL9mdMSqeMxtG2iCVg4fvQXuyOXWzVvQjDkecFd+Y72kIilF5HKmnTYCR9rbpGlqdMDyz2hqaS6tbSzvM0+U+bcEseUzc$ FxP3tkDN/qqbfc48+6yJp89muNmhlsp5W8wfiNk5jbfCX7q0EuTkE+Wk8VT6IksnpyNrKXa6Qka2 7Y6eqoVz45qizvb24KJt7a5JeVKa0tMm5plX6CtzpfN7eozhOn+4IaitO/+mzklrBWMOR1/LjkFI KwrdkTFayAHG56N9EGpnjBCfM0IcGKGQ2dc6KaNCIqEwSYBygv4ivzw3C6b/PAs2KbLv9H+OBZsh $\label{phi} FhDHSrBfLZAbMiCN01zphzOrtMMzV2ktg1zVNrnmapueyX3GKu1f/MU5rNIyTN220Su27N1UXb/t4BWX791YnR7Xx/sbqwcqrYaygYbkQKUFv7fh8Dfamq4a3bzhpze0zbpq9GtNQ32R4u6hecClxV1D$ YgacvotB0MvpGbC7ks11wNf9pQy4Vd39V2fAn3eP6RnwWVTgszJgSEKWBWfV17kmdcFc7HRAJhxs 7+qPrhIz4J0a4tlxc5mYAa8oL5tbosdjW565vkX1jDjTS30Wif1tTjEuKKov1nVeP7I1eUFfmUrM gN+Y3RrvXUvmDXUoszq0PjtvAiqwmAKPLCrWyUZZWkGzYvDPibtFuF9ghXBbQKV3teozep+zKcvF rOJIdsawn1//tBBY9lnykVKHIOJnC3RmR6E+VAoT5bQJ4m2orrYpHC4TJ2Eout0XsbBiyOurKxk/ duYUGYrPCqhomZz19eKOWevEe9TH0PtW9N7UKnRkchV6jgB+lIngyIkqcCfsv2uqBNEQVLmqKDqz $\label{eq:dkyqw3VgWarrzvn4hlh03GZQiytVyIDVj0HjSaUQd7PI+vFgZgF5+WBYPTYI/2YsTguu/8tP+xJr1tHyXW39MeXtMQMPFPAy7mwkKr0VAR1/vr03s56f3zZDQ0hbqFEW8DQtIwvkAeS7TFP3KUONHT3$ djcEsKNjUldQZTTpSOvsXr3M7LAoLUUWR9hl85QIixuFizpCfKFepdI7jVaPTqY36ZUWr84Zctnc JcIiGCXjxAfULczjqAbdQUbpoEajqClG3lLRuxoVpbmZWQr51j5vil2Ru6AQFluMLWXiG9iCLCsc JGTIGCX JANIUSZ JARKQUOPOSE JQCTGSILKUXOVPDMZWGF51JSVIIZKUAQFIUMLWAIGSICLESE
MJXHM6YtMR4/EteQNPhJVPplbkKsPXP21GImYmfIpbvULVyhN1pla7+0xXORVieq5YWcnXiB59hM
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i7IzmguSRRontVxQaUtbg5zE3JrdjAVfdtpyijhDM2Y/k4Epz6X62dZepgLDjNWvrJpahXlZNGju
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5Uq3SoypNuKZNxvxB4WD8bpKfG5wIpzciSLgLnM38GIbbn+pYAnVrvDkZnOfv5RZIIbMRVz2Fodr kbbtXuufdb4bfRk2+k3rqhuGo5WifpiBewi6Fadlis+mUq7LPlHcVwVPpW1+KxVDZbD4OHjpxsCu b6Rio3ZNPVR9NpJXTmkTC+tM50W2coYpPgPcG2rcio/yusKjo9t1V4SywT4Wu27ga0Sm4iaPtHpi U5G0enKNbytEY/fqKb6nZUku8RdXN/VCnm8rRO4ikSpzKidyxM0RqpTQ2tOyU5R3bS2C1C9yVZEg 4vXNEok0ZyhNovpm2UpLDKXJSFOttCKRZkkVZakNIIHPq0UPGEVVvhurG4L+aiY2dbI2IHa2p4AM 2VPQJMl6rBHtmVlsxHiKOb2Q0wutdJ3THZ5ibH8cDjcf9aDfg+MPBuwjl1TNW5i3i5zhbjZNcNC3 $\label{lem:wxnTDT3} $$ \pX_{\rm SD}^2\pX_{\rm SD}^2\pX_{$ cSGKzqotIjliMfJ6D7Lq/W5QW6X6ydiMaib/RbuslJm4ldXMmQLRLjuTrBMUExdtRA3gu8ohwjED 0CD+HNXV1uBFbJVdAH0nGjEYUWYYKe0KoA6yKngs+FuFoXLRl7mZic00yXMdziAPWrTkQLYRl1FR B4Zj1Y9Biic3VB1tOUUSt/GqlergmccKgXZKs/mo5/r0sF//LA9uZx9vTHJBhiyi6mD7BKMWjNPZ PjVOJAeDzrizV7Do5Yxr9TnRXTYbe5XcuFNARj2zom5tbtLg/jgB5NjOkgc1PvpYj9N3Rp/k1PBf XIFWStuFHvOKBW2YeVwbSn51PV2mPQR/EzCb/FoW4jvJL+8GniePthDpDeTXX6NLtXnA7dSofoNy Yj4DxZxWUIq8wtwP3wP0ATQ7vUL9XszZwXNW30AY81ZutOYvb6NEZS3SP7DpYEP7kUYImpwH918x H6ZZCKBde2inVCDfQQXKKcpquioKDRS0PQ8w7cPBaxAOXo8Q1N0Y/53k4z2g3mueUP+AcBRorcHv Sz71KPw7EB9GPv1B4Fdo7xukf0k+nWiq+jHwKeZ1K8qxvw15H1K1GqQ8tD1CXUQd9FdQZz74QDX6 $\label{local-power-power} J/TJ/ZwH9GHmMQaPpz14fFo8DeUxnhMYfzh4LlqJmE+BmNOD1Et+0PwBfg4wDEi2033a4LZzbsVBGqx+grY/tmnwcRgtzgP6JotWITDN2kPQMASm5XmAaR0OQfNwMP1DwHgFDbH+Sg722niaLL9PU7C/$ LlayaIrsoEKlG/VXgjRCOkqjpC+pC87BCOkQjdAGOCjlLqBelOe6F8tvOCj5NRonF4KfrKWRynCcu63UW+mFegjL+6nYcTEVRP03FWi5VOCYgXALwm6EX4TvgP8Q4EP6EcQ7IrwF/t9pEnhulTyKhgId iE43AU8gPBuYQdTSG/HT8ijzKPANwr8CVtjxr8/E6TrEX2EgPo2BNBXxEwhvBu5GPMqOP2jFza+ATxFeDqA+9geA8HsM5H0JHEL4PmA18jYwMKahwBCEhyAdbRDG0NIf4R/gz5Y+plR5BBUC9yJ8mT6A /iY/TVcIPEXPAL9nKPdTDVD0kD6namBEyFeysU+yz/ho5wKlL10AvlEdDrV/GHoBMeBjt9PX2AM1 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fWr96/WKuz4uIY8Ts0b1yMhLfGzmkrwH7vX0SL0ns1/ePfdK3tH3Suvv1r2JdxcW5f35binGcBkrDGVkn0SQwIXJK+m2r9q+V1QRJ09aYA0QXK17bloqeRcv0bxLVvTssXq15F0FrFipeW8GXMNSUoemgarangersparenter for the control of the control$ pAxJSRqckjAoJTYnJeqCFH1gipKdQgnSmiv30bKSgvTM3vF9eick9JP6HDe9x39O0Hos/shP8Q0P DjwuHz4u9fPGZ3kTenrie3kS0nrEu3skJCR2i12KjonVHc5YRdViSZJjdSXQIyahMkGOoQuhKsyK WqisinqcHon6OCEqhmKUmIQL6cKoaqU26hplYcKv6ddR9yVsjfoLxW+V0qWeRUkJLq17XKqjalxK Yuc4iAlxPUbGS+n8HxThJgLZQCGwCXhJSi/K1LPy++X3yc/M75XfM9+dn5bvyk/NT81Pyk/Ij8rX 85V8yq8aNEUykiqpckqx0VGCP7nYGOStbFbck4wcb6URVVXra5Kk/6hGqiGvbpZoiqGubpbhJZXU 1PqapS6cvdK11SSJjEr/ylurvd7uRoD/i/qy7tVgDgdu715N1UbORMPlKfa2/y1YaHtXt0k1jpQZ x8tmlxnHPaXG0bLZiPiNo57SBVZuvzIjq6z061PETE9pmwaldu0TOrD6YG/BAnS1gENGqlGI+bYf T1MUT7xqUrEh11xSaQQmVRquq1q/0dVTXGnsQmxoVa0R6y1esGBBE8k1U5pkdnQ4tbW+kd21NMjr 3YFuQGegE5AEdAASgDggGogCnIAOaIBaNC5wMnAi8G3gQOCLwOeBzwIfBd4PvB3YHXgjsCuwM/Bq 4A+BHYFtgabAlsC6wNpAMLAmcEtgZWBF4ObA8sBNgWWBpYElgcWBiYGqQEVgdMD7r/yq/6VaELy2 O3g6hb9RoiwaSIOpT1EKrUjockug6+6UxHt6xt6rpXTSuvVMoMLCwsS/JR5IPCBlH8o+cMFAacjg AnlYgTJkcKanZ7zs8AwZOnRQTpqckoxIvJKS0jnFM0TqkN6BIQ/TO/Xr1TnTlTCywD2wV5cof/6a kvL6gm4JvfKz3JkpjqTbpVOndaXuVK70VadOGf2G906SPSjPUzkpuVdO2vK0AdOHlffNLBhR3j89q3efbvrc3/ym5YC64eQs9diJJzB667crgggiiCCCCCKIIIIIIogggggiiCCCCCKIIIIIIogggggi iCCCCCKIIIIIIogggggiiCCCCCKIIIIIIIogggggiiOD/McTTU3AV419AuBx20AnEJLJ+Od1006xQR+1206wi/JAd1hF+zg47aLH0BreiRiG12/9ip1pSIoiBaN1+GPzfwFq5EdvBnaDCONArR2TUtWam 0zPBns6QZDyBC72AuPACHkFw58K9R3DhDcSFCL6ERkREFHQnoVOvXlUllU54UVLiiKajVomHaT7q 13gE+KzEY8DXwEPA6Ce6LzH6GU7okpiWqYqxAtQgrW0ypMniy8iBqwMZ6odZgFFABcWI1CjHYGqC 61AXMRs8CSuRfYQ5RWYddT1qgVFAjNnnSViHKp/JgTfAnRB1gfXVDOz3TeH1YA0dgtNvNZ9Hsx+d xXdUhLV8N0x78FTowe+/AySCZ8OeBdilsgP97gRteANEXTinz44veblaXeGGahttdea4rklfG+GU LmKu5Tk3VafrLDelleZIpvHmVq2xnSzURa91lFjc0Hn6ParErCxL5brSsGAjO8o6aWTKzohU9oQ5 Sbt60F/z9jbpHj/NvVyMP1c04HpNC5r3KsAA111G/A0KZW5kc3RyZWFtDWVuZG9iag0zMyAwIG9i aq08PC9GaWx0ZXIvRmxhdGVEZWNvZGUvTGVuZ3RoIDIxNT4+c3RyZWFtDQpo31RQu27DMAzc9RUc W3SQ4jZDAMNLunjoA7WTXZFoR0BNCbQ8+O8rCU7aDiTBIw93pDy2ry25CPKTvekwwuDIMs5+YYNw wdER7CqwzsStK91M0oBM5G6d104tDR7qWsivNJwjr/DQ9/sn9Qjygy2yozEhL9XpnJBuCeEbJ6QI CpoGLA5CHt90eNcTgizEX7BfA0JV+t2m7S3OQRtkTSNCrZR6bm4Fyf6f31iXwVw1iz/bh0ak7Q3P vHzT3YdZmJPFcngxki04wvtvgg9ZLYf4EWAA2Fhqbw0KZW5kc3RyZWFtDWVuZG9iag0zNCAwIG9i ag08PC9GaWx0ZXIvRmxhdGVEZWNvZGUvTGVuZ3RoIDE0NjEyL0x1bmd0aDEgNDEzOTY+PnN0cmVh bQ0KaN7Uew18VdW1/jrjvZlDSCBwIdxwSRhuIBimBEMSyAAhDGHSm0ThhlwwRCYFR0YRBC74nFEpCrVWW4dyoj5fUEGsiqiIONTaOhQR61BQtAjIkPO+tc854SbSwuv/3/f7vUu+PY9r7732WmsfSCKi OFpOClWOn5SdM3HnU08i5WMgWDendn5odvhqoo07iaTlddcu9FYXTNmHcD6RPG7m/CvmfJo25Voi ZT1R700rzt8w88uVy2cSVaOSdX6ifkZt6MDs4cuIfrkY702uR0LUfyWnECXsR7xH/ZyF1y/7dPC7 RIkqOcATs+fVluqXRAOlmvEK4qfn1F4/v919cfei/mUo751bO2fGgMUn1xBtmk2kfjt/3oKFGDd+ m82w/vyr28x/NV8bT1RymkjvQoq6R36BNHJr67UBXMzypeM0U2qWE2TVzWiqrsjqfpLN11Knkf0b O8nrJS/RKVXPa86Tal0bpde8JG3mPGW/NoV710ULUzwRYonkFy6pOexaP2W/FTaPmA+wa4WJmida 4dY/fQklKsPMIzJqmVtQoh1dwM9tQ+XIEvqUdovku7Ge9fDvo3U0jIJJ01T9t5Ef6H/+kAmmwlFfqQb+itVJ/KV1KpfV2eo7Ui37XUnApXUP76EHaRHfQAqrHZvuB9tMK5EynuS2leHwj8I+oWkzH6iNe 6kdHsc8mnmMA79MelEhC/j6aStfTONqAvj6mA7xv6RvaHzHWrBY3jHFsgX8r8KzInI74LSLNoBB6 J3qMrqbRbdZmB7nlhVifm7Au++kDJFlDU6jgpYehUh8pjX4Duh/EyDbIKn0snaSd600IFI+UZzHj dKnvK3oGOUGOkLXYtwfN3/Y/I15RC3XJe1RVwVRUfWM0LSp119WU10VmDJ54tgxFaPLR40sKyke/ $\label{thm:mbyosGBY/sVD83KHDB40cEDORf2z+/XN8vfp3atnZkYPX/d0b7e0r108nTulduyQktw+qVliQnxcbEx0lNula6oiS5QlpRqpxYHSBqNTcdCl9ZX4Er1G7LgjY7MNSvKk+9p5B2RX9bVLGZrfoPYVRnJ1}$ oj G KcqsM3d+2yDhDyUj8IR2Vx3q8pYaagT/f6NqQ0Wt1IN2X+IGnJb8KdYzOxYH0dI8hZ+CvHFn4G13rDRmJ1UhP91gp5QzVBhhN5oFcJFJuehXciQEjzYlWVZ1rkNtwsna2GeY4KZzYGNupuMSg5EaKPWBQChc7kouVzjd6+TGQRIREa5RtSMk/GFJ7Q0oZiyG37oKr7c89Bw1KQw2+0tAsUDQUPEvTIxZF071hb3hioN0ABMWgK4zdEwKNMdHFvuIZ0UggkUCNOTFIieEENDG/UYotkERAji0d2iiTOw7kS+Lh ljIajKJ1QQR8JaAbctqfzWkyd66PzCJUc0LtrZA1CEMvNlzWILyzjKJag9Z5G7N2htc3JdL0oD82 5AvVXhYwlFoUaCQlo7R+stGlorIaSegKCNZ7eblLhMOL5y2t94YR57JBuL4SXvRW6aH6GUHeJlLQ

V4K8qOLA6vSdHiMJfqnRzm/EoVjcjQc9Srg0dZaXo+Hwaq+xBcONyE1nF5sgFUMP1/rQGxorbRjB S5LdsmxiN5aHxOIUrav1GsunN1h7r3a9s/Tw4lG7LF0rA7WBzVFRZuUoWADD7mhlqdz2uANr5shprpeTA371VvaUMLgitj9NAWlqw019b7Ssx1i4ggoGW3rpqcbnfxcMRwu5SHWhjB6a8jIODt+PhMedical Control Controlv4TxFBtFk4VHk8UaoMei2pIqO8kuUM3VOCdYUlWVbq07ihqujNVaP583zC26Moxkf2L6K8jb2Ter YmKgtMQjZm/IxYFhh1M9hxGuqGxJ1lJRJpx92GPRqGKSr2KCtQvqHSc42TrAcsvKo6hdXrT6Vqrn LSt8WaDMVxYMh8t83rJwMFzbZC6f7vMm+sKNsbHh+aVBrzj+EtKfW+cxytZXGYnBemmoWCFuzst7 r2xihdF+0q0vVZm3vtZiHIW+9FxPeruWMpX/KNs+c9i90AN85sKJhzC2WHAni7eMWU0T0ITHSMz1 I4sBTQngTNSJ/SscnJVJaNzDp0apyiidNckmFnamvXmYB06wU9FIejqfp3VNRTQdEWP5hIAV99J0 z1NU103H0gY5Z6eTkzKFc5Y7OS3Vgz6sW2rFpPPs78i9HW7nS/LmZQv6C9YbMnZOxhxP5BruXHvp 2xcHF19sh2SPwqFoP1hZvtHRLyoyTcAxw4k+7z6fkeg3t0LATk9+1TexHVidhDKj/HyCwFH3+V6X mI9ScqIh5RtSB04n8FXB3pWOuchs2UjeOnDQ3mmR07Ivg1D9ueeGMok+TM9j1W+X5OMZ7hHszeba GWV8rjzpVonRVUY882Yj/pBwMF5PccALToST00EEvKXeel5swxssESyhyhOZ3GTuD5YwC8SQuYjH 3uJwLdR23mt9sy50oy/HRr9pfVX9ULRS1acz8A5Ct+K0TA7YVMr12CeK+yrngbT0b6GiUwaLj40XbvTv/HogNmrn1MNV5yJ5xeRWsYjORF5uC2eYHDDK/E7jVnyk3xMZHdUmu9zJBvtY4rmRrxGZRjT6 pDUTGoukNZOqA9sgGnvXTA48JUtycXBEVWMP5AW2QeQuEqkyp3IiR7wcoQoJrT0lu0V5z7YiouUi VxUJI17XJJFIcztpEtU1yVZaopMmI0210opEmiVV1KbWgwQBHxY9ZBRVBhZX1YeDVUxs6mBtQOxs XwEZsq+gUZL1WCPaN20EEeMbwemFnF5opeuc7vKNwPbH4fDyUQ8HfTj+YMAB8khVvIV5u8gZ3ibT BAd9C5w33dAzLgPAYKP8VV7s4tEoN5IRRPJIY31dLY+Dt6nCvLy8rspwtzSIIuVGFFqIsltAitJR h28bVKrDZq31iSCScTiWVxlVfu40MIsb8HohD43yDTX0TKtNLZM7yq4KJ/lyxHWiZxjRGavZi8LY mBGKFA+i6KzKIpIrFi0v8yGrLugFtVWqm4TNqGbyX7THSpmBW13NnCEQ7bEzyTpBMXHRR1Q/vqtc IhzTDw3iz1VVZO1exFbbbdB3ohGDEWVGkNKuAOoqq5zHqr/VGCoXfYmbmdBEE33X4wzyoEVLLmOb cRnltWA4Vv0YpPhyncpoyy2SuI1XrFQXzzxWCLSTm8xHfTekR/z6ZvlwOwd4Y5IHMmQRVYXbJhg1 YJzutqlxIjkcdsedu4JFL3dci8+J3tJZ2KvkxZ0CMuqZ5bXrcpMG9sUJINfG5jyim0jj3c7cFX2K UyJ/cQVaCe0QeszLFrQh5gltMAXVDXSF9iv4m4FZFNSyEN9FQXkP8Bz5tIVIr6eg/ipdrs0DbqcG 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vR/9VX6KZgv8jp4GfstQHqBqoIwhfUZVwDDHV7KxT7LP+mjnIqU3XQS+URUJtW8EegAx4G0301fY A9UMtw3dhrKe7pEH0WqGUkKPAX4lnx4C/PL39BLQ4mNtxwNn/c1UonanGQLFuG+eAS9z5Avcn5qP LhL3M99DfB8/TA3ivsU9q+WaJxzZAnt5mrgzN6EsZAz1Oeop7sNR5g96A+YAuUJ/BvGjNEqOv808 pB8wDyl/Mw/xXa7nII4UUX6BeUg9irm+TQ+pD9NMdZX5HvjAZcr32PePUL36pvmWSP+ASN5Ct61/oNFqHnVUP0X5q6irchvuZfBtTTePqFvpPvUL00g9tHcNyahHuht0S0d8jPkmxlaohxBGf9w+t81t Aqq8xdwi7gDUcSDK2nzX5rUZgmfhfAo+pVM18yHmP4InOjy3zOK3oGdA8N4J1CX4xFPmt9oddDHz W+0E9cU9M1q0jzZbeDj4nOBDKCvKo4w8m17AvvTIo83biE6f4D3pgPepMoBOMASte2KteD1ZDppP abyerlsoQa0EP/kz0hgh4GmKFuu5y5YRf2OvJctxWEv1B+qlXwLaYi2116kKe6DS7aWg+2KaqleA V9yGet1R/g4qc70h2kzhPtWLIYPegPphyJ8sM9nyni27DRNymz0G1/vUznUU5R+1+u0x6CWgLY/n Ueom5I61oMVC3MOv4S7cTX1ZftBHUjJ4cK4WQ5cwsB/Llb9QsrYF/1Fb/nkb6/CaJauoftABd6vW jDSWe75GmV2U45Ko3OWBfOClNH0u0iagnx8oV5+E8D3k4T6VhxG+kzKRXsN3vyPD2PKIj+UvZwz6 w5SsN4m2M8V9/jba9qFvHs+ziK+hS8V6P4w9wXvqIPzjGA/WX3+PktVUnLtx2AuMGGAalgh7iveG 2E9+ez/xPcv7aTpFa/txjnk/Fa180SjXbAq4FiF6E+aEuxDzCKhumuRS40+jB04TskUAMmYetyPu MvsudvYf36nOGFxjKNrVB+EDdn8Yg7YaYR7PGPL18813GOCddcB43JcbgTzBw2LoYvk4zq1CS5Ra WuKaZkHfS3MZ2g2Uqe+mkPo03a21QT5aT0XC3w4E6HrE74R/HeKGWMerqRBpFcLfTleqr5n3a+k0 Fml58P04X+Uymoh7cKp70vjU9+Ab62mBMpB6qRpkNBX8bT1kq07Yk+uxPzvh/K2naUA11wMeAK4C Foty68FPuJwVt8ptp6uUSZDHCmmIWirGMVCdQtNVg+aqY2gc4kGEK7kc8CAwG1gmym1H+9tRbjst $\label{lem:pew20+XKMs} Few20+XKMsjoy0CfZSLcAJQBy4CpwCwgAEwEZgBXMCDrrgJy/jfq0onm0tcarNteYA10pL0UjIkWy78eWGT7v5CraYUdvwtYayPPzo/EPEXHGq6iDP0ozcHdUalcQf10L/XHWemlvQq6fkib9Uaq0/5E$ ndXrMaZG80sLHC/rR7y31JnUi8icAowBLgf/TAIGYI+GgQbw0XsBvvMvt+JnbgJuAR6x5QXH/7XtrwNuZ9nhQnVlBz/Xf82nIuMtemlrfbR7ZBw86ZxwdEz95n0jlZ7ZSp8zvz+vzvdz3Y0i4y06Wsd qlNkXJtzbjj6kLb53GilF12gTtKCn+kZkA0i4o7+0EbuHx4Z13aeG44sr715brSS56EP810qdG/m 13tpA+YT0uYif0nOqPVnPeVvwB8xJqYn65WbzJ+U561EG0wZ/lv4JUAX4Jc0Uk2hEjkZvEC5d5GW AJnOgL74FvAJyt+BNPafEXmlkI+y0Fa2soritPGUotwIHXkm7gEf8VnIt9DMcnoQ4c9sdMHZOAb $\label{lem:condition} CvtsCPnaKiOAndBcDnQDUuWRZw4C36HM2wA4/pk9Fprd9v1h8B3xKtr9Cen9EN5syenc95kngWnAXbY+wP3Nt/UAPofDbGg25gDXoa3NFs7Ms3Ca9YuL00Zwu02ewyXAbgC6RnMfmwfY8z7zn1Wumdts$ tus8aY3zzH57HpfaqLJ9vucWAh2AJstulxwNxACJQILNU4JWv829gViEWefItWBinibP8xDQM4Lu vwYdHXq9GoG7bTh5TOc3bfzRgtP2mTdsPGXjmI0dNrbaSLMgxgycMW28bs+b9bBddnzHWb95iMUH zzwGFAEz/onfHZhwlhd99bzwZjBk8zQhr15EZeq9kM1Y9nyCeuvXiPQK9bfgbWzHrMS908u8WtgJ O10KvJ8uAb9MY73E3YEuleaZlwn73Wrww+eRnoRzlYc72NJLegvdZDPN1u5Ge9fY9rY56G80211M 5dFuCkZdD31Uhfz5HtrsTZe7/gzZGLwb/fQRPPhctr0Im6hWZtsxF57149yH0zbnuSBfu59E+AYe s9V+5P0g7zE3iXk5fN+xRdr9CRme5fV1KH+aZj12W2FPbWPLZH4v8tg2ezXuVZbpPahfBHrMoi6s z4k+n4Ps+ADqTIaMZNdh/cFBi123Dc5p142wS7cF5qWx/C/oY60V7da2XTs4nw1X6Cpfn7XVXrDN 9h/ZbduDDrZdvMU2HmEfb8Fi6GeLzVehr/QWfX4G/MXSmcUe5nysOe6IzsJu9wb51N/Z9lvI//ImcwVDP01D1W24Y1+gMvlFihc67R7oEE+ibBPlKjsgyxyjDPkUZWiX2nbB76mX8gXq9KIsN+veB2io qxD3L+5q3B2dbbvvz+20Y21SpA0X9+EhYXdlG6p9TysfQ+6/Euoyt8t571vtRsoB8kpzM9tiW+00 0mC2kTr9KCbk6100FPp2UF0q9IwRLfXb21rZ1vkOyq6CjrUb84OepX+DPQAo79M4YWt9D3O+FvrT MBogPOouhrBpvwldCfX1E+YrLIfjzsuT+9LjygvOuPwspcpltNKxnTtosaG3xTnsOyxDRtrZ2wJ0+MoClpZpaEPYoK+jdkA6EMf2eAdtbdI/owfb61lfjbQ9/wP7M8sTkTjnmtuyU4udmfXeCJt/i42Z 54M2WmzRvJfusOzbYl9ehjGlmX+Gfj1Ui6ahos5482us2TDIIkOUaTSVbSzaKsh9OyDH/JomQq+c $\label{local-prop} {\tt JOZA8TRY2430h1EnD/ycZa8MmqYcMxepd4D31oJW9914eSelsg3FVQ355iNzo7DB/hX1k1H3UDSZ} {\tt gLN12VAsOepjnLMj0L0+tm2m0JuBaeogqozSKBAF/qRfB536JHg6eLBbgi4IuZBtyWIM57LPRti11} {\tt gln12VAsOepjnLMj0L0+tm2m0JuBaeogqozSKBAF/qRfB536JHg6eLBbgi4IuZBtyWIM57LPRti112VABAeogqozSkBAF/qRfB54AeogqozSkBAF/qRfB54AeogqozSkBAF/qRfB54AeogqozSkBAF/qRfB54AeogqozSkBAF/qRfB6AeogqozSkBAF/qRfB6AeogqozSkBAF/qRfB6AeogqozS$ MQfLHvllhIyYerZtznM9Qgf3D4Q/ownC5tNG9pQfMp9Ff11a6jv2ZKc/vWH2LLfSuQ7tvfeP5NL a4QsyXmsrx8FrUAD5Y8ovw/hP1GMyBuAPg1K1GSU34N01JGH0Fblc9oqv09pch7d0fKG4MCx1bfB uez0kW8NbeHY5wW9bLSyx9vvEQ70a5e/1bZzbG+N89rh/5EtfhF4uP3W0fLeEfnmYUOsB9posc2D XoLe1Yhygr+dgsDzA7gXh0107HM3+ZTbEW+iTeJMME95H+A7AXwX9J+oPmvHmWftpGSBzTR0mWB+ 52qPs/q+ucLmp+XqRpzvpeY8eS2Ac6kp4HX3giYP8pnGeJhPQ0+ADAUZy4Rc2cwy3FFgPOIK5KrP $\label{eq:control} Ed4Hv8CST8/83pajZw0XIY/17DXAf9myMdvSByKdbffjbRTYcubNZ/sRcvhUK+3MWNuvj4hvsbHSQvNkcU+z/GHLduwLm+828zD7Q17gMr1opL4WZ/R2ylavxTn+E2j1MM1UPgRNPsSZ/QB6JyR1/Vvo$ cRtoqbqVZOU/kfcs9XV8tvEqP9F9go6vÜj7u8vvRvk/ZSiHxRroVcbYdf9LyTjWpxbdtrQyxz18Hn11EQ7RjNEV5gDKVF3HGL+G9bh7SA+Ze/TVzr3aPuUmrM3/UbzIP6KCw3g1pQzCvDfab/Vn80zqu lyA/vmQech8w90ZNMPe6u5mbXIfNH6NizANRY4jcv0U9SPf6d2jjJMK/JHJ1RH119Bo0FPBX0iG1 uzugbjraG2Vu0qEVuAvMA+6uKLsYaS6uj7JsXz1PWXc15NW1RNFbzL3Rj2NM75qboqYgvts8EP0o Th3cq07b0rpgtD0RHmduwj10Wol5QPNhnVYgLY51-ZHIf5vvpkNxcy1Cf4cw82g9rofNx64VMSZo
cfo21P0WPnaR60ekQ4NzDUS5F5H2PPKwT8SeeQHpr2N8uWhHw7j/gvj3GDd2rus21H80PpgLvzmc
r6x7KY2KKsNcJmGOv8ccb8McZyG+CHOEhhPdCXM4ar0T/Dsh3jj+CcTbx78J9rtHZ3mLuRPYgfBy +N8ATCAGONHGFrtsqR2Ogv/led/S+S2GEfGe8q+A32D+Xfgf25UuEK6s8+N87+Lnumf/X+B68/yw 7WKjc28fAb61450R/grYBXxmY59jQ7PD413+vG/rzr0ewW8vFPwO9v8TrubzQ/Bvv31Y7wP+shz8 rgb8e6B5TC8H/10MXvMR+Mub4N8vmofd08BHkhH/Dvx7t3nm/Qn4dyJ46zzUV767F7znr+A9+SjT ETzpr8jTwJNykX4v0qvBd6eD99wInrQPbT0OnnQj4veDJ+2B70c7zNt+h/K7UB78Vz+OdnYh/gXa ${\tt SYV/HdLXgLeNQPlqtGOgnXVopxrxG9DOE/BjzL3ySNoCrAa2AmPkkeaD8FPh7wA28bs88CxwN7DVaparameters and the {\tt Syv/HdLXgLeNQPlqtGOgnXVopxrxG9DOE/BjzL3ySNoCrAa2AmPkkeaD8FPh7wA28bs88CxwN7DVaparameters and {\tt Syv/HdLXgNoCrAa2AmPkkeaD8FPh7wA28bs88CxwN7DVaparameters and {\tt Syv/HdLXgNoCrAa2AmPkkeaD8FPh7wA28bs88CxwN7DVap$ xkN2vSjr3Z2ekc00Stiu76ZJrANr3ak3dGZ+e+yt5UP2/sx+d9yGvGeAOdRbvxVyFnRmVx4FMeag

3s2SEYR9wrZTa1XQw69CuZWQkZcCdSi31vyQwf3xe6b2KNpromht0/w3hT2hUn/jrE1FfKMWYRdx 3kDZJtPyDhppT7iDyvgN0gG3x++Z/M6pTjOvVj8V9oA4zLHMNZPK9K9oOHSTStxX0W6Z38fpCn0o51AJXWgLxsVvgjWUrr4N/ekd6qZeB93+JuvdUj1M5dCNytWnKFNbT2mQ2cv1DOAFjO+A9T2V82YpBA9T2V82YpBA9T2V82YpBA9T2V82YpBA9T2V82YpBA9T2V82YpBA9T2V82YpBA9T2V82YpBA9T2V82YpBA9T2V82YPBA9T2V87YPPA9T2V87YPPA9T2V87YPPA9T2V87YPPA9T2V87YPPA9T2V87YPPA9T2V87YPPAcCkl6osQfwcy9rsAdDyt0TzG4LdQ9Y/W+6e6337/3EU5/BYqXwW9NFLvZ/2WbQGA84bK8mTL02oE /+Z30FY2eLTJ76H8Tqq8Y65RC4Q+GcPyrg75VjsBPbs99dMh2+qs394CXaGI0oT8u4+Stek495uh v92Lu+1bGsx6nX7UfvPsBx51JVAIffEn0AMyNvhzwJWJtGxbXmPZ3rGr30Mp+iuUp6XQKM1No1iH 0t4wTzGYJ/FbqsZ152AdsuFXWG+jevJZPU3oeRG6lvP+GvkG24p3uUG36RTtgNvjt1R+Y1U0mqvU oNApEjG2AfrdlAN616mTsVfGUbTrIrR1P+hxD+YA/Ve7FG2MpkGgaRDIB41q1BKq0PvTVPGu/Q5o v5RqHIBH918a9Wnows9DB3iZiuEX4+yNV1TzkDyT+mGuQyH7FLk6gu7vABsgT4/GnGYCLBc/TF0EHhB+v1JJw5Qp0Gk20hhhT3jEvF1+wLxZGUse+T6zTv4VcMj8Rq8jiXU01Wd/J9hAi7BfspVJpCkj $\label{eq:kppwPr} KFppwPr+iWbomTSG3+ixbyZC96zBHhwpLzPrVMM8pDxH49VXLf3Hqefic7UUOCq++cxQDwLfUYYeRxmu8VSgzcL+ThD2MR/6fAxn3cNQp5ontU/No3qQKqCPpS1fo6+9aP8AwsdBj89phLxOfBPYSf0N$ DVFewV5qRNkN2CO/xZ7+Euv7EGT5J7Aez1E81m4S1mFKy74fg7YepiT1NtB9EPjAMhqofkPL9WGod5TCOAfR+nTQAnIt+q5UdqDt28krvk3A2MQ3B2hD+0/K5PPI7zjQ7X4UbznHMUbnLWciDT3PW86w lveczTRavOnwe479liPecfibsBy6WAnTpeojlvdhzrdhygAaK79KA+WXkNaF+krHqJS/DRPfha2z vguTP8AY+Psw+xuxlu/COmL/Z1rfh6GdBLS/QrkKaz0NazsPZUdRNH9vxt+T0d+RnauM/i726tvmr8DPg/Juc6drpLlfPQ28Yz6mvGLuVBYDx81jyhBzv3IG9K2mztDlRqtJ1Mm1iTLk31CC/JFpanHm GfVR8yfsB0nY8sBv2DanfS7OTuvvXh37GdvJbjXnCb4lkBJb7JC7bN0cfJD5kjhr7WkS690suytkfi/smD9i76yhYfy9nfw15hNEmU+pkL+5k91Y15tB5zAN19MoFbQYIRONk3vh/izHvZhFA/gbPNB/ HOg4UssAjfZinp+BXldRBdNbvRFnTnyLZx6Ty0H3p0G7mejnCvRdK2iaxN/jKdcByWj/Q4xnDs5xGGMMUyl/6ye+53uZeiluoAZ3G3/Lx9/x2d9aRH6PJktUAZTJ15AmTwHvcd7inxbfXoSkzXS9PJj6 AjkifBkly4PBSwdDd54KDKZKeRjNBaYh7ouE9HlzM9pK477teY/lbwrlaZjTJAq1hZrcGkjLhN8 6Aik2uFOSHfD1wA1wleVSaapJmNPJJvNNk4Dp5B+yg63Atrh9mKBhDZoO450EX1xQDyHkS7Db98G SVZ/YrytYJcn9G1G1rHbjz/HWP7ZOFrG8vNxiPbpPONIajt2u/3Ec4z1fOMQY7HpfOrndBbrcqrN 2pyx17HVGnIY6RnwO9vqtU+x17710LKokSG/Q33FNyzZ2GMIq89Hy2Ohd4y1vvnEuctRfqM8iX35 EpG0Cft1LWTctbTE8cEjc5S5wDMo/yzOw5fAEsqRP4NMNYtWMARfzbL5In8bC16qEmR1wPH1xwH+ PxpTkDYX/sNWmK52/h+H+TGQYfnNE6SNyH8NZbeL74eq1WL6ir+L4rpJ34fK/THP5yikleCs/Y4e
UyBcyLvoWnkcbdFmQlbaTlcA423/SsHvtlNq9HHI0LhbXVMgX26nEv5+Bv5F0QHIitupJ8Dxiep2 8+/290fXAoMgd490vWP+5DpGS4DLI/wGoMyOL7P9Bjs8S3+GFuAOK3N811T431EZQ1tNb2iLaIN2 ku5xPU87BH/5g/S1+gfzdi3P/ETLky+24ITNT9xDaLaWDF14AnjyMhqiHoFM1w26QBp1xB1fre7G fbqJNmO9EpQT1BeydQ1kauz6M/2BoUAOMMq2geZZtkr+tuD0EQAa1uk/Ah8pAUogOv4iAG3reDfX 6BjyRCVATuyEsjU2UEf5gmqif6E98jmN1+8CD6zHHdRAPuXP1EeZT3nKPipUQuDB++G/Tf247P8FaC+D5j9AHyukwDbySmnPRKVKo71NU1cn0MUJdHQCHZxAkhNo5wQSnECcE4h2AlF0w00EdCeg0QG1 6GsROiXck8L9RrgHhfu5cD8T7qfC/VC47wn3LeHuEe7rwt0t3F3CfUW4vxfuTuFuF26jcLcKd71w 1wk3LNy1wr1FuKuEu1K4Nwt3hXBvEu5y4S4T71LhLhHuBOFWCrdcuKPYzR6eLWVSITAemAbMA5YB twGbga3Ai8DbQAxlk3pQNlAIjAemAfOAZGBtwGZgK/AiEIOF9BVdL/11f4eOXd7/A5xFizt4Fi3u 9M67CF97HZw58+HMngfnyrkdPFfOXXZ154XXJKdOuaIBzsxZcGbUJ3tm1K+6qnOnBR1uLO6UfgPg eq3ja/KXX0n+hU9LHXdIPT8I7pi/Y/kO9f6Nsr9oozTtLumOO2V/k3mkKPFvnq55UXWpda/VKd66 uIQ8Tswa2S0jL/GxGUvzHrzPly313sw+effeJ/lH3SdtuEf2J95TWJT3p3ukGMNjrDSU4XGSSwIX Jr+k275q+lpReZj864ClQHiV7r9pmeRfslTzL13ZvduaVZJ/NbBylea/GfAMSUkdnJIyKCVpYErC gJTYnJSoilL0/ilKdgrlS2mSvEXLiwvSM3vG9+qZkNBH6nXC9J/4KeHY8fijP8b3P9b/hHzkhNTH H5/lT+jui+/hS0jrFu/tlpCQ2C42KjomVne5YxVViyVJjtWVULeYhIoEOYYuhqowM2qhsjrqcXok 6qOBqBiKUWISLqaLo6qUmqhrlYUJv6BfRN2fsC3qzxS/TUqXuhclJXikrnGprs5xKYkd4yA2xHUb Hi+1839OhJsIZAOFwGbqRSm9KFPPyu+T3ys/M79Hfvd8b35avic/NT8lPyk/IT8qX89X8im/csBk yUiqoIrJI4z2EvxJI4wB/oomxTvRyPFXGFGVNYFGSfqPKqQa8pomiSYb6pomGV5ScXVNoEnqxNmr PNtIksioCK66tcrv72qE+L+oL+9aZeRw4PauVVRh5EwwPL4R/ra/BQtt75pWqcbRUuNE6axa44Sv xDhWOguRoHHMV7LAyu1TamSV1hq9kJjpK2nVoNSmfUIHVh/sLViArhZwyEg1CjHftuNpj0KJV04c YcjFllUYoYkVhqeyJmh09o2oMHYjNriyxoj1jViwYEEjycWTG2V2dDg1NYHhXaU0yOtdgS5AR6AD kASOAxKAOCAaiALcgA5ogFoONnQqdDL0Tehg6PPQZ6FPQx+G3gu9FdoTej2007Qr9Ero96Gdoe2h xtDW0PrQulA4tDZ0S2hVaGXo5tCK0E2h5aFloaWhJaEJocpQeWhUyP+v/Kr+pVoQvHZAerqFv1Gi LOpPA61XUQqtTOh0S6rnnpTEe7vH3qeldNC6dE+gwsLCxL8mHkw8KGUfzj54UX9p0MACeUiBMmhg pq97vOzyDRo8eEBOmpySjEi8kpLSMcU3SGqX3o4hD9E79OnRMdOTMLzA279Hp6hg/trisrqCLgk9 8rO8msmupNul02d0pfzOrvRlhw4ZfQb17JQ9IM9XMTG5R07airR+XQeU9c4sGFbWNz2rZ68u+txf /rL5oLrx1Ez1+MknMHqJgphHT20K85VGSS6eEiiaSL5En9dn+FRfWkJmt8zszBcz1Sg1M90f51fS 7izCdndTamVqMHV+KtJTUlK6K13vTPlv9q0Eul3rPL/dt1gAxLU4F8Q13CABAiABkiAGHisQkkiR lEXKFE3REkVJFMWlEi2S0thWdMSiHcvNxDpMh3bcuEpgsZGTdMZn0pk0sS3LbmrNxPGRSTutj8QZ H03slLXbSBbYfxcLXqIlecbTaadL6APf7r597/3f/7/v/e+NyJlNZ7JmTCsVyjNZhS8YCCArx7JRFzqkJazxtxKGdNx2Ab4uJFA8okdJa2ME2azMHyLIypzr27xJzlcQrs7H4ZI5v6mi3M5lv4zRIOtl 99gTMLkwa/ZUgYf01TEyVOXR+2Kkz6dPJqqrU8n8BUnQDFvqu/z7QMRMy8yRIH7hmCfGtT9zJJ70 $\label{thm:poles} $$qPbuVXsTsSOXqlJes16WySitpVw53hTnSoqLMrln+5pCOezMNuTaGlc6UN4HsgHwQQ06LfqgPKzB$$ $$mhNc2GcJnygvN8kpzFrYMlnaYgiUJ7G3wufznsn6MDoUUalqw9pDjgLDybdQI2+qngVrk1Bik2Af$$$$ DldW5xkkdwODDnSjyKCZNSOMgUNarcupNxBpYGo2AOGb50W3uLJlQYUlYoI3jSSuMKgDZFJcWjjwvvKGUisMXFXsr63ht2m8t9fCWCtQPXpeHG3KbitLJstw8iSHygg7LivTEtoETpzUclrNmawWV3hJ $\verb|mullwf7| MafpuhkhhhwgJhklCf0Jjb8| MeguDhlY/cPY+7| fsfaahsDq3ct3VNf6gxvD6d01zbstaXqErVakuqh7et2lnPHjm0YWE4eLyOrr2tW7+xqbTIvavz7t7eosy67zzaxllzf99a59dSD11+NdK+$ s+HuuyFGMqB0/wy8e9E9IutBAwLTsVbH2eQ60Zaf5HTYQyDiTBYZ9HYNp7Ufomm/Twya120XmNcv FEKHNx8lgZILwEWC59X2+a3NxtPit3ryz0UXAj2vNDKeJj7aiAPhCivdUcfFvapj1APHjBa7y5ss $b \verb|RaEJyNnwyvK8TuOuoEo0Zc7neWiLoPyM7uoOGCtHXbTT4C1PnRAtLaEVtowK/cw2GqFSW/FOrcP| \\$ G3Ran9fDGPRuBg5YrAw4WOigJHM+oWfT4Pj8PxRnk42CEoAo8Maal2wM7FxOr4eorgZP53VBTvqw 4SPy04emzSbWSCSNdLfWlEwSpw0JElfu2B/fzv3HxdwrFm/YTdoqE84fEsvefh/nYps81RVUJqMo XdN96cf40c+6qC2dnFuRydCxcNUtl11vwZ59R/NyKzXxE9cqmkA3W5W0i3SE5PZ2VK4kiVQn26/zYP8npGIsLW11TnMViMxz1eMJF9glbQUJBHcBPaZC8vLt4FXxekE/X1VsC65d8scdYGc0hqgBw0kAm ObBjkrIwnA5SWLf1qCAi/NIBAY4a84sjbwA/318SfH316xxlyVu5qHIPwfK2Basq+aQSpr4vKGQ5 Zpj5YCpe17716eHf/O7g+9/qOJ05r6urCTQlXWVb19U0EmjTlvUzH//1hwdY0582bwj0PrBv3+nu BK+X4NN7wKduFEePixZVuZzTWRds7EzghSnOxNAKrDhL07LpLE0ri+I4oongyCSnsSiULEYT8XhF yVFGNPQtNolmPRSP8za8EymY09gouLr0ujuY5+012+ohTC6SNct8qdACaqoEuQwkCdH9QixUV1E0 maEknvvoNqWu+eGWp57c85sHyrpqaWMwQZgP5t7o7GroiW7ojXTVEv62VWF7UZPyONFyw8VLZ9+7 VcX07uqJ24qatJfR7ft7/mbs+WcjPbXAIB8Rf4aIKAY0fyYyW0s2YvcUd4uR0BmXGW8w9hkpCzYa i3AR5E9TXBGDigkVLsbYgi2THLYUI80EzeZ1GyfowkT50/kEKsQAyFmjbd7qsEnM0OJfsJu5qFq6 $\label{eq:control} xz7AfBItLP/xCLGVwnyo0xL8xo4X73jvg9v+9VTvsa3uoNFEXL6L0HxH2+2rf0o1r2vvVT41vHHm\\ 0nc/uC3cWtXYsX7/k4+mm4nWB+5/6BTMnVpY174Osbz8do0oCeml0Fwans4ypeblLjugDwyUqUlN$ Z2tQLaGYMJvr17snyufkA9xeCirkbAbFk+G8alt81rXUe7yI8raaZ7MtU1hrhaiBe5Rwj+Lv5VWG+GXvva17bk1htTloz9njPo1mWUVJcH0K0yqD15GzuLxGLYWLTMEwxBS+ua0pY+q23Kmy9pjTBGmL Krymj5BtH6l3xTtiua/W1HtsFgPclxuLQys5rN7QkfKYFKBBz/OK2wJf9blRhJEdPSFylsYkxts4 HXkDSc60hI78GfkGFCqlIhmSZDCpP6vTaaez0l0xZaems3bC0BomFAgn0lxgzzHn5vYIMKN4/2/e tHdUDKryL9r+vPx/cWs9BLCHRUoF+vKMEi/n/viVioBGWRzxEsaDInVW2cgnn1x8RRNu7iNerqjz G+VZxeV0gSKUjyCyHCKIResKmajZNJ0115ag5LQc5ANNaDTF1kWZaF51dIurWuc9BiERU+85XXMvqQPJgkOVZsGhhKevOaK501/86MBb9JugBD3oV+LoOIVfJaxko01EFnMUhzmQd6bnbHf3hulst461VVS2yNqSxa2tbdPZVv2ES1E2UeOqqXH19qCVE+uEuIfAT8fjDOSiokX5zYNA99ximA9tQRa+YK8i 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0jppSUxyJVQWFcoORVZfsyty1Kxd5UH6gF3xyuqHOt2g00KuzkxDxmxGD9mR3mGXVeKTHWpdX0fI $\label{local-posterior} 4b \texttt{PjeJGE+FqlNhhfVAiR+AQkE5BSZyk9ETKriugEneUoj1CQpmFWaqZid6gZip2noLich79VbVrlcdizzGZvUaFKagNKiwpKjZpk0U2gVg+jGmpVox5G7uTTgf1ypHAk9GDUBC0+S2Kr0upf71GZ38tjgpHAk9GDUBC0+S2Kr0upf71GZ48tjgpHAk9GDUBC0+S2Kr0upf71GZ48tjgpHAk9GDUBC0+S2Kr0upf71GZ48tjgpHAk9GDU$ vH777EgqhJr7T2ZY5YypmqLCiCl5orCR6UkxInHarURwUqdTujmnnM2TlSU8I2UZ7ghVDsiYiUfB OZXyLlqKoUApmuHjJeiltuKKdKpxtb6QqZzLub8q5pqUOfQp4A5QPvxqqsQfkxhyTJ8CJ/k+mdxr qL9JqxaLWlDAt4ixFtcUc6zS+TuKCvui1Kb0mGREWD5owtr6veUlWH6zmS/w/qgVWpBRB1Z5JngZ WrkGwFpi8arUxzUjNzUzV3PNwE3NpLtPwZ18CvilbqYq5U7+JZnSZjq6y1WS9i3q4ITe6Vkcq9Z6 ZEfIF6ut0z2Fm9CXTupilDqj1sOyaIyiWUzX4qZcP2nMGU+iKuTgn0Hf1K1Ro4S7UpcQuU41+ZZO 9N54s/m/6RTVrnIvHX31FktTLbdM5Sum8FPSSwwxTFjIpU7321AofooOD3hNRCH7VkWsZJ9rrWfY hDfUfW7PECW011fjjcxFnWdYBrDqUjop5ZzMOXAS3LBDVNJVWcNWgAFdK+gCnQ9ECegy6aaMQCBK J2QmXYZPEfA11BL68S4trRk/caNYuqyv6q3PGeE1/JXnzxd4e0ZEj8NF8RT4BYAcoRVWGY5DvaEM 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GBcSFBQUFBIXFxscHhwbFyQkJyckJDUzMzMlOzs70zs70zs70wsNCwsNbg0Qbg4QFA4PDhQUEBER EBQdFBQVFBQdJRoXFxcXGiUgIx4eHiMgKCglJSgoMjIwMjI70zs70zs70zs7/8AAEQgAKQBHAwEi AAIRAQMRAf/EAT8AAAEFAQEBAQEBAAAAAAAAAAAAAQIEBQYHCAKKCWEAAQUBAQEBAQEAAAAAAAAA $\label{eq:local_alpha} $$ AQACAwQFBgcICQoLEAABBAEDAgQCBQcGCAUDDDMBAAIRAwQhEjEFQVFhEyJxgTIGFJGhsUIjJBVSwWIzNHKC0UMHJZJT8OHxY3M1FqKygyZEk1RkRcKjdDYX01xiZfKzhMPTdePzRieUpIW01cTU5PS1$ tcXV5fVWZnaGlqa2xtbm9jdHV2d3h5ent8fX5/cRAAICAQIEBAMEBQYHBwYFNQEAAhEDITESBEFR YXEiEwUygZEUobFCI8FS0fAzJGLhcoKSQ1MVY3M08SUGFqKygwcmNcLSRJNUoxdkRVU2dGXi8rOE w9N14/NG1KSFtJXE1OT0pbXF1eX1VmZ2hpamtsbW5vYnN0dXZ3eH16e3x//aAAwDAQACEQMRAD8A 9VVfPtNOFfaDtLK3E08CBonysujEr9S520Ew0dyT2AXIfWLrd3VrD0fC0y1vuzrgdA39yVFmz0x0 10ZoANn10VnmyR0qANymdgBu9B9W0p06n0ejJeZfGx5PdzeStZcV9T0p14dTMSwFtGVdY3Gd21nb 5rtUcM+LHEncgWnn8PtcxkAFQMiYeV/sUkkkpGqpJJJJSkkkklPFdVys3Itys8c1u+y4FPY00jrfiEI9M+xYTOn4v6TLyfpP71zvpPd8FsZGAWX01whtVxcf7XCk/Hsa622v+evd6VZ/dZ4hc5zWaWfJ $\label{eq:cosxjxkzypqson260zH0IxjGFC04HTTSN+A3eT6ix2PmYd016aemEE0H51k+93zXo7bgMUXv42b3\\ R8JK5rK6RTW2mlsSTL31bznh3TbC36IqcB8mwr/w7mpZcmWM/SRREf5fRh57JHLHBWvCZAy6mzv9\\ R8JK5rW4mlsSTL31bznh3TbC36IqcB8mwr/w7mpZcmWM/SRREf5fRh57JHLHBWvCZAy6mzv9\\ R8JK5rW4mlsSTL31bznh3TbC36IqcB8mwr/w7mpZcmWM/SRREf5fRh57JHLHBWvCZAy6mzv9\\ R8JK5rW4mlsSTL31bznh3TbC36IqcB8mwr/w7mpZcmWM/SRREf5fRh57JHLHBWvCZAy6mzv9\\ R8JK5rW4mlsSTL31bznh3TbC36IqcB8mwr/w7mpZcmWM/SRReffRh57MW/SRREffRh57MW/SRReffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRREffRh57MW/SRReffRh57MW/SRReffRh57MW/SRReffRh57MW/SRReffRh57MW/SRReffRh57MW/SRReffRh57MW/SRReffRh57MW$ 70svrVWPknFbRbfaloe4VtmAVzg9b9ldS9ctNv7RbvLPozubwtPJ/aX7cyD051QsFLSRaCZ07Qm8 Z/L9rKeUxRketCXzSqOgh1/wnVx+qUZGFZmVtefSa4vpI/SAtE7dviks7pVpHQsrNq3HMe22y4H6 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Appendix C. Mapping from requirements

This informative appendix provides a mapping from the requirements of each end-product clinical specification to a logical element (profiled FHIR resource) and its corresponding mapping to a CDA schema element (in a CDA template).

The mapping from requirements tables in this appendix demonstrates the logical decomposition of each requirement to the lowest possible element in the applicable logical model and CDA template.

Legend for mapping from requirements

Data item	Req No.	Logical element	CDA schema element	Additional notes
The heading text of the requirement as taken from the requirements specification.	The requirement number as taken from the require- ment specification.	Either the name of the lowest element in a profiled FHIR resource that addresses the requirement or n/a where the requirement has been deemed not applicable. If the lowest possible decomposition is to the resource then only the resource name (e.g. Patient) is present. If the lowest possible decomposition is to one or more child elements of a FHIR resource then a ">" notation is used to indicate the hierarchical relationship. For example Patient > communication > language indicates the requirement maps to the language element, that is a child of the communication element, in the Patient FHIR resource. Where a requirement is addressed by multiple elements, the elements are presented in order of appearance in the profiled FHIR resource.	Either the path to the lowest level CDA schema element in a template that addresses the requirement or n/a where the requirement has been deemed not applicable to a CDA template. The syntax for this uses an XPath like notation and starts as the root element ClinicalDocument e.g. ClinicalDocument/recordTarget/patientRole/patient/name Where an element is addressed by multiple CDA schema element paths, each path is presented.	Additional notes are provided where a gap between a requirement, or parts of a requirement, and the templates is identified. Where a requirement is fully addressed by the mapped elements then no entry in this column is expected.

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C.1 Mapping from ACP information requirements

The table below provides mapping from the requirements in *My Health Record Advance Care Planning Information Requirements [NEHT2015x]* to the corresponding supported element in the Composition (Advance Care Planning) model and their corresponding CDA schema element(s) in the Composition (Advance Care Planning) template from the root ClinicalDocument.

See C.1 Legend for mapping from requirements for an explanation of requirements mapping table presentation.

Data item	Req No.	Logical element	CDA schema element	Additional notes
Individual's electronic communication details (optional)	024042	Patient > telecom	/ClinicalDocument/recordTarget/patientRole/patient/telecom	
			/ClinicalDocument/author/assignedAuthor/assignedPerson/telecom	
Individual Healthcare Identifier (mandatory)	022082	Patient > identifier	/ClinicalDocument/recordTarget/patientRole/patient/ext:asEntityIdentifier	
			/Clinical Document/author/assigned Author/assigned Person/ext: as Entity I dentifier	
Individual's title (optional)	022081	Patient > name	/ClinicalDocument/recordTarget/patientRole/patient/name	
			/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
Individual's given name (optional)	023056	Patient > name	/ClinicalDocument/recordTarget/patientRole/patient/name	
			/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
Individual's family name (mandatory)	023058	Patient > name	/ClinicalDocument/recordTarget/patientRole/patient/name	
maividual 3 family name (mandatory)			/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
Individual's name suffix (optional)	023059	Patient > name	/ClinicalDocument/recordTarget/patientRole/patient/name	
marviduar's name sumx (optionar)			/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
Individual's sex (mandatory)	024032	n/a; related to Patient > gender	/ClinicalDocument/recordTarget/patientRole/patient/administrativeGenderCode	
marviadar s sex (maridater y)			/ClinicalDocument/author/assignedAuthor/assignedPerson/ext:administrativeGenderCode	
Individual's date of birth (mandatory)	023060	Patient > birthdate	/ClinicalDocument/recordTarget/patientRole/patient/birthTime	
Date of birth accuracy indicator (option-	024026	Patient > birthdate > date-accuracy-in- dicator	/ClinicalDocument/component/structuredBody/component[admin_obs]/section/entry[dob_acc]/observation/value:CS	
al)	027005			
Healthcare provider organisation name (mandatory)	023070	Organization > name	/ClinicalDocument/author/assignedAuthor/representedOrganization/name	
Healthcare provider individual's work- place address (optional)	024035	Practitioner > address	/ClinicalDocument/author/assignedAuthor/addr	
Healthcare provider individual's work- place electronic communication details (mandatory)	024892	Practitioner > telecom	/ClinicalDocument/author/assignedAuthor/telecom	
Healthcare Provider Identifier-Individual (mandatory)	023066	PractitionerRole > identifier	/ClinicalDocument/author/assignedAuthor/assignedPerson/ext:asEntityIdentifier	

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Data item	Req No.	Logical element	CDA schema element	Additional notes
Healthcare Provider Identifier-Organisation (mandatory)	023071	Organization > identifier	/ClinicalDocument/author/assignedAuthor/representedOrganization/ext:asEntityIdentifier	
Healthcare provider's title (optional)	023061	Practitioner > name	/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
Healthcare provider given name (optional)	023062	Practitioner > name	/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
Healthcare provider family name (mandatory)	023064	Practitioner > name	/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
Healthcare provider name suffix (optional)	023065	Practitioner > name	/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
Individual's electronic communication	024042	Patient > telecom	/ClinicalDocument/author/assignedAuthor/assignedPerson/telecom	
details (optional)		RelatedPerson > telecom		
		Practitioner > telecom		
Individual's title (optional)	022081	Patient > name	/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
		RelatedPerson > name		
		Practitioner > name		
Individual's given name (optional)	023056	Patient > name	/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
		RelatedPerson > name		
		Practitioner > name		
Individual's family name (mandatory)	023058	Patient > name	/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
		RelatedPerson > name		
		Practitioner > name		
Individual's family name (mandatory)	023058	Patient > name	/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
		RelatedPerson > name		
		Practitioner > name		
Individual's name suffix (optional)	023059	Patient > name	/ClinicalDocument/author/assignedAuthor/assignedPerson/name	
		RelatedPerson > name		
		Practitioner > name		
CDA document author identifier	027383	Patient > identifier	/ClinicalDocument/author/assignedAuthor/assignedPerson/ext:asEntityIdentifier	
		RelatedPerson > identifier		
		Practitioner > identifier		
Document type	026956	Composition > type	/ClinicalDocument/code	
Document title	027207	Composition > title	/ClinicalDocument/title	

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Data item	Req No.	Logical element	CDA schema element	Additional notes
Date paper document was written (mandatory)	022070	DocumentReference > created	/ClinicalDocument/component/structuredBody/component[aci]/section/entry[doc_ref_acp]/act/effectiveTime	
Single ACP attachment (mandatory)	022062	DocumentReference > content > attachment	/ClinicalDocument/component/structuredBody/component[aci]/section/entry[doc_ref_acp]/act/reference[content]/externalDocument/text:ED	
Paper document author (mandatory)	022064	DocumentReference > author	/ClinicalDocument/component/structuredBody/component[aci]/section/entry[doc_ref_acp]/act/author	
Attachment author contact details	027149	DocumentReference > author	$/ Clinical Document/component/structured Body/component[aci]/section/entry[doc_ref_acp]/author \\$	
Total attachment size (mandatory)	022068	n/a		
Attachment document type (mandatory)	022049	DocumentReference > type	/ClinicalDocument/component/structuredBody/component[aci]/section/entry[doc_ref_acp]/act/reference[content]/externalDocument/code	
	027148			

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