TOVE Digital City Programming Manual  
Shelter Pattern Reasoning

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# Introduction

This report documents the TOVE Digital City (TDC) Python OWLReady2 (Lamy, 2017) functions that support the use of the TDC Shelter Pattern defined in OWL and can be found at: http://ontology.eil.utoronto.ca/tove/dt/Shelter.owl.

In the remainder of this report, we use the following ontology prefix’s:

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| --- | --- |
| **Prefix** | **IRI** |
| 5087-1 | http://ontology.eil.utoronto.ca/5087/5087-1/ |

# Shelter Representation

**Prefix table**

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| --- | --- |
| **Prefix** | **URI** |
| agent | http://ontology.eil.utoronto.ca/5087/Agent/ |
| building | http://ontology.eil.utoronto.ca/5087/Building/ |
| cityunits | http://ontology.eil.utoronto.ca/5087/CityUnits/ |
| contact | http://ontology.eil.utoronto.ca/5087/Contact/ |
| contract | http://ontology.eil.utoronto.ca/5087/Contract/ |
| i72 | http://ontology.eil.utoronto.ca/ISO21972/iso21972# |
| organization | http://ontology.eil.utoronto.ca/5087/Organization/ |
| person | http://ontology.eil.utoronto.ca/5087/Person/ |
| resource | http://ontology.eil.utoronto.ca/5087/Resource/ |
| service | http://ontology.eil.utoronto.ca/5087/CityService/ |

**Shelter ontology**

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| --- | --- | --- |
| Object | Property | Value Restriction |
| CommunityPartner | rdfs:subClassOf | organization:NonProfitOrganization |
| contract:hasContract | only contract:Contract |
| EmergencyShelterOperator | rdfs:subClassOf | ShelterOrganization |
| service:hasProgram | only EmergencyShelterProgram |
| TransitionalShelterOperator | rdfs:subClassOf | ShelterOrganization |
| service:hasProgram | only TransitionalShelterProgram |

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| --- | --- | --- |
| Object | Property | Value Restriction |
| ShelterOrganization | rdfs:subClassOf | CommunityPartner |
| operates | min 1 Shelter |
| contact:hasPhoneNumber | only xsd:nonNegativeInteger |
| contact:hasOperatingHours | only contact:HoursOfOperation |
| hasSector | only {women, men, youth, mixed adult, family} |
| hasBudget | only cityunits:MonetaryValue |
| fundedBy | only organization:Organization |
| hasSupervisor | min 1 person:Person |
| resource:hasCapacity | only Capacity |
| hasOccupancy | only Occupancy |
| hasOccupancyRate | only OccupancyRate |

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| --- | --- | --- |
| Object | Property | Value Restriction |
| ShelterSector | rdfs:subClassOf | ShelterThing |
| hasSector | only {women, men, youth, mixed adult, family} |

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| --- | --- | --- |
| Object | Property | Value Restriction |
| Shelter | rdfs:subClassOf | organization:NonProfitOrganization |
| hasBuilding | only ShelterBuilding |
| operatedBy | exactly 1 ShelterOrganization |
| contact:hasPhoneNumber | only xsd:nonNegativeInteger |
| contact:hasOperatingHours | only contact:HoursOfOperation |
| service:hasProgram | only service:Program |
| isPetAllowed | exactly 1 xsd:boolean |
| resource:hasCapacity | exactly 1 Capacity |
| hasOccupancy | exactly 1 Occupancy |
| hasOccupancyRate | exactly 1 OccupancyRate |

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| --- | --- | --- |
| Object | Property | Value Restriction |
| ShelterBuilding | rdfs:subClassOf | building:Building |
| contact:hasAddress | exactly 1 contact:WorkAddress |
| building:hasNumberOfRooms | only xsd:int |
| hasNumberOfBeds | only xsd:int |
| hasRoom | only Room |

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| --- | --- | --- |
| Object | Property | Value Restriction |
| EmergencyShelterProgram | rdfs:subClassOf | shelterThing |
| rdfs:subClassOf | service: Program |
| service:hasBeneficialStakeholder | only Occupant |
| TransitionalShelterProgram | rdfs:subClassOf | shelterThing |
| rdfs:subClassOf | service:Program |
| service:hasBeneficialStakeholder | only (Occupant and (hasReferrer min 1 Referrer)) |

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| Object | Property | Value Restriction |
| Capacity | rdfs:subClassOf | i72: quantity |
| i72:unit\_of\_measure | only {i72: population cardinality unit} |
| Occupancy | rdfs:subClassOf | i72:quantity |
| i72:unit\_of\_measure | only {i72: population cardinality unit} |
| OccupancyRate | rdfs:subClassOf | i72:RatioIndicator |

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| --- | --- | --- |
| Object | Property | Value Restriction |
| AdultShelter | rdfs:subClassOf | Shelter |
| hasRoom | only (Room and (hasOccupant only Adult)) |
| service:hasBeneficialStakeholder | only Adult |
| YouthShelter | rdfs:subClassOf | Shelter |
| hasRoom | hasRoom only (Room and (hasOccupant only Youth)) |
| service:hasBeneficialStakeholder | only Youth |
| MenShelter | rdfs:subClassOf | Shelter |
| hasRoom | only (Room and (hasOccupant only Man)) |
| service:hasBeneficialStakeholder | only Men |
| WomenShelter | rdfs:subClassOf | Shelter |
| hasRoom | only (Room and (hasOccupant only Woman)) |
| service:hasBeneficialStakeholder | only Women |
| FamilyShelter | rdfs:subClassOf | Shelter |
| hasRoom | only (Room and (hasOccupant only Family)) |
| service:hasBeneficialStakeholder | only Family |

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| Object | Property | Value Restriction |
| Room | rdfs:subClassOf | shelterThing |
| schema:identifier | exactly 1 xsd:string |
| hasBed | only Bed |
| forFamily | min 1 Family |
| hasNumberOfBeds | only xsd:int |
| hasNumberOfMats | only xsd:int |
| hasNumberOfCots | only xsd:int |
| inShelter | exactly 1 Shelter Building |
| hasConfiguration | only cityunits: Area |

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| Object | Property | Value Restriction |
| Bed | rdfs:subClassOf | shelterThing |
| schema:identifier | exactly 1 xsd:string |
| bedType | exactly 1 {“regular”, “mat”, “cot”} |
| hasOccupant | only Occupant |
| forRoom (functional) | exactly 1 Room |
| TwinSizeBed | rdfs:subClassOf | Bed |
| hasLength | only xsd:int[<= "75"^^xsd:int] |
| hasWidth | only xsd:int[<= "38"^^xsd:int] |
| FullSizeBed | rdfs:subClassOf | Bed |
| hasLength | only xsd:int[<= "75"^^xsd:int] |
| hasWidth | only xsd:int[<= "53"^^xsd:int] |
| QueenSizeBed | rdfs:subClassOf | Bed |
| hasLength | only xsd:int[<= "80"^^xsd:int] |
| hasWidth | only xsd:int[<= "60"^^xsd:int] |
| KingSizeBed | rdfs:subClassOf | Bed |
| hasLength | only xsd:int[<= "80"^^xsd:int] |
| hasWidth | only xsd:int[<= "76"^^xsd:int] |

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| Object | Property | Value Restriction |
| person:Person | rdfs:subClassOf | person:PersonOntology |
| atAge | exactly 1 xsd:int |
| person:hasSex | exactly 1 person:Sex |
| hasBed | exactly 1 Bed |
| hasNumberOfPets | exactly 1 xsd:int |
| hasFamilyName | only xsd:string |
| hasGivenName | only xsd:string |
| inRoom | exactly 1 Room |
| inShelter | exactly 1 Shelter |

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| --- | --- | --- |
| Object | Property | Value Restriction |
| Adult | rdfs:subClassOf | person:Person |
| atAge | only xsd:int[ >=18] |
| Youth | rdfs:subClassOf | person:Person |
| atAge | only xsd:int[ >= 16,<=24 ] |
| Men | rdfs:subClassOf | Adult |
| person:hasSex | {“female”} |
| Women | rdfs:subClassOf | Adult |
| person:hasSex | {“male”} |

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| Object | Property | Value Restriction |
| Family | rdfs:subClassOf | shelterThing |
| hasMember | only person:Person |
| hasFamilyName | only xsd:string |

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| --- | --- | --- |
| Object | Property | Value Restriction |
| Occupant | rdfs:subClassOf | shelterThing |
| rdfs:subClassOf | service:Stakeholder |
| rdfs:subClassOf | person:Person |
| schema:identifier | exactly 1 xsd:string |
| hasReferrer | only Referrer |
| forTimeInterval | only time:DateTimeInterval |

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| Object | Property | Value Restriction |
| Referrer | rdfs:subClassOf | agent: Agent |

# Shelter Functions (http://ontology.eil.utoronto.ca/dt/code/shelter.py)

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| **getCapacity(inst, constraints, dtd=None )** | |
| *returns the number of Occupants in a shelter for a given datetime subject to a set of constraints.* | |
| **inst** | Instance of class Shelter for which the occupany is to be returned. |
| **constraints** | List of constraint triples that instances Occupant must satisfy to be included in the count.  **Object Constraint:** (property, predicate, value) with predicates: "eq", "type". E.g., (hasOccupant, "type", SeniorOccupant)  **Data Constraint:** (property, predicate, value) predicates: "lt", "gt", "le", "ge", "eq". E.g., (hasAge, "lt", 18) |
| **dtd** | a DateTimeDescription specifying the instant at which occupancy is to be determined. |
| **Returns** | an integer representing the total capacity across all manifestations valid at time dtd and satisfying constraints |
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| **Returns** |  |
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# References

Lamy JB. 2017. Owlready: Ontology-oriented programming in Python with automatic classification and high level constructs for biomedical ontologies. Artificial Intelligence In Medicine 2017;80:11-28