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<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://www.decision-deck.org/xmcd3" xmlns:x3="http://www.decision-deck.org/xmcd3"
  elementFormDefault="unqualified">
5   <xs:annotation>
      <xs:documentation>In each set, if ordering is required, it is assumed
        to be ascending (first element = least preferred).
      </xs:documentation>
    </xs:annotation>
10
    <!-- Function -->
    <xs:complexType name="functionType" abstract="true" />

    <!-- ExponentialFunction -->
15   <xs:complexType name="exponentialFunctionType">
      <xs:annotation>
        <xs:documentation>A function of the form  $u(x)=1-e^{-ax}$ 
        </xs:documentation>
      </xs:annotation>
20   <xs:complexContent>
      <xs:extension base="x3:functionType">
        <xs:sequence>
          <xs:element name="exponent" type="xs:double" />
        </xs:sequence>
25   </xs:extension>
    </xs:complexContent>
  </xs:complexType>

  <!-- Point2D -->
30   <xs:complexType name="point2DType">
    <xs:sequence>
      <xs:element name="x" type="xs:double" />
      <xs:element name="y" type="xs:double" />
    </xs:sequence>
35   </xs:complexType>

  <!-- PiecewiseLinearFunction -->
  <xs:complexType name="piecewiseLinearFunctionType">
    <xs:complexContent>
40   <xs:extension base="x3:functionType">
      <xs:sequence>
        <xs:element name="point" type="x3:point2DType"
          minOccurs="2" maxOccurs="unbounded" />
      </xs:sequence>
45   </xs:extension>
    </xs:complexContent>
  </xs:complexType>

  <!-- AffineLinear -->
50   <xs:complexType name="affineLinearFunctionType">
    <xs:complexContent>
      <xs:extension base="x3:functionType">
        <xs:sequence>
          <xs:element name="a" type="xs:double" minOccurs="1"
55   maxOccurs="1" />
          <xs:element name="b" type="xs:double" minOccurs="1"
          maxOccurs="1" />
        </xs:sequence>
      </xs:extension>
60   </xs:complexContent>
    </xs:complexType>

  <!-- KeyedEntity -->
  <xs:complexType name="keyedEntityType" abstract="true">
65   <xs:sequence>
    <xs:element name="id" type="xs:string" minOccurs="1"
      maxOccurs="1"></xs:element>
    </xs:sequence>
  </xs:complexType>
70
  <xs:attributeGroup name="keyedEntityReferenceAttributeGroup">
    <xs:attribute name="ref" type="xs:string" use="required">
      <xs:annotation>
        <xs:documentation>Reference to named entity</xs:documentation>
75   </xs:annotation>
      </xs:attribute>
    </xs:attributeGroup>

  <xs:complexType name="keyedEntityReference">
80   <xs:attributeGroup ref="x3:keyedEntityReferenceAttributeGroup"></xs:attributeGroup>
  </xs:complexType>

  <!-- Alternative -->
  <xs:complexType name="alternativeType" abstract="false">
85   <xs:complexContent>
    <xs:extension base="x3:keyedEntityType" />
    </xs:complexContent>
  </xs:complexType>
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90 <xs:complexType name="alternativeReference">
  <xs:complexContent>
    <xs:restriction base="x3:keyedEntityReference">
      <xs:attributeGroup ref="x3:keyedEntityReferenceAttributeGroup"/></xs:attributeGroup>
    </xs:restriction>
95 </xs:complexContent>
</xs:complexType>

<xs:complexType name="alternativeSetType">
  <xs:sequence>
100 <xs:element name="alternative" type="x3:alternativeType"
    minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

105 <!-- Category -->
<xs:complexType name="categoryType">
  <xs:complexContent>
    <xs:extension base="x3:keyedEntityType" />
    </xs:complexContent>
110 </xs:complexType>

<xs:complexType name="categoryReference">
  <xs:complexContent>
    <xs:restriction base="x3:keyedEntityReference">
      <xs:attributeGroup ref="x3:keyedEntityReferenceAttributeGroup"/></xs:attributeGroup>
    </xs:restriction>
115 </xs:complexContent>
</xs:complexType>

120 <xs:complexType name="categorySetType">
  <xs:sequence>
    <xs:element name="category" type="x3:categoryType"
      minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
125 </xs:complexType>

<!-- Attribute -->
<xs:complexType name="attributeType" abstract="false">
130 <xs:complexContent>
  <xs:extension base="x3:keyedEntityType" />
  </xs:extension>
</xs:complexContent>
</xs:complexType>

135 <xs:complexType name="attributeReference">
  <xs:complexContent>
    <xs:restriction base="x3:keyedEntityReference">
      <xs:attributeGroup ref="x3:keyedEntityReferenceAttributeGroup"/></xs:attributeGroup>
    </xs:restriction>
140 </xs:complexContent>
</xs:complexType>

<xs:complexType name="attributeSetType">
145 <xs:sequence>
  <xs:element name="attribute" type="x3:attributeType"
    minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

150 <xs:complexType name="nominalToCardinalType">
  <xs:sequence>
    <xs:element name="nominalFrom" type="x3:attributeReference" />
    <xs:element name="cardinalTo" type="x3:attributeReference" />
155 <xs:sequence minOccurs="1" maxOccurs="unbounded">
  <xs:element name="category" type="x3:categoryReference" />
  <xs:element name="value" type="xs:double" />
  </xs:sequence>
</xs:sequence>
160 </xs:complexType>

<xs:complexType name="nominalToCardinalSetType">
  <xs:sequence>
    <xs:element name="nominalToCardinal" type="x3:nominalToCardinalType"
165 minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

<!-- Measurement -->
170 <xs:complexType name="measurementType" abstract="true" />

<!-- ExactMeasurement -->
<xs:complexType name="exactMeasurementType">
  <xs:complexContent>
175 <xs:extension base="x3:measurementType">
  <xs:sequence>
    <xs:element name="value" type="xs:double" />
  </xs:sequence>
</xs:complexContent>
</xs:complexType>
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    </xs:extension>
180 </xs:complexContent>
</xs:complexType>

<!-- BinaryMeasurement -->
<xs:complexType name="binaryMeasurementType">
185 <xs:complexContent>
  <xs:extension base="x3:measurementType">
    <xs:sequence>
      <xs:element name="value" type="xs:boolean" />
    </xs:sequence>
190 </xs:extension>
  </xs:complexContent>
</xs:complexType>

<!-- Interval -->
195 <xs:complexType name="intervalType">
  <xs:complexContent>
    <xs:extension base="x3:measurementType">
      <xs:sequence>
        <xs:element name="begin" type="xs:double" />
200 <xs:element name="end" type="xs:double" />
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
205

<!-- Gaussian -->
<xs:complexType name="gaussianType">
  <xs:complexContent>
    <xs:extension base="x3:measurementType">
210 <xs:sequence>
      <xs:element name="mu" type="xs:double" />
      <xs:element name="sigma" type="xs:double" />
    </xs:sequence>
  </xs:extension>
215 </xs:complexContent>
</xs:complexType>

<!-- ExactNominalMeasurement -->
<xs:complexType name="nominalMeasurementType">
220 <xs:complexContent>
  <xs:extension base="x3:measurementType">
    <xs:sequence>
      <xs:element name="value" type="x3:categoryType" />
    </xs:sequence>
225 </xs:extension>
  </xs:complexContent>
</xs:complexType>

<!-- ImpreciseNominalMeasurement -->
230 <xs:complexType name="impreciseNominalMeasurementType">
  <xs:complexContent>
    <xs:extension base="x3:measurementType">
      <xs:sequence minOccurs="1" maxOccurs="unbounded">
        <xs:element name="category" type="x3:categoryType" />
235 <xs:element name="probability" type="xs:double" />
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
240

<!-- Criterion -->
<xs:complexType name="criterionType" abstract="true">
  <xs:complexContent>
    <xs:extension base="x3:keyedEntityType">
245 <xs:sequence>
      <xs:element name="attribute" type="x3:attributeReference"></xs:element>
    </xs:sequence>
  </xs:extension>
  </xs:complexContent>
250 </xs:complexType>

<xs:complexType name="criterionReference">
  <xs:complexContent>
    <xs:restriction base="x3:keyedEntityReference">
255 <xs:attributeGroup ref="x3:keyedEntityReferenceAttributeGroup"></xs:attributeGroup>
    </xs:restriction>
  </xs:complexContent>
</xs:complexType>

260 <xs:complexType name="criterionSetType">
  <xs:sequence>
    <xs:element name="criterion" type="x3:criterionType"
      minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
265 </xs:complexType>

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<!-- DirectUtilityCriterion -->
270 <xs:complexType name="directUtilityCriterionType">
  <xs:complexContent>
    <xs:extension base="x3:criterionType">
      <xs:sequence>
        <xs:element name="value" minOccurs="1" maxOccurs="unbounded">
          <xs:complexType>
275           <xs:sequence>
             <xs:choice>
               <xs:element name="alternative" type="x3:alternativeReference"
                 minOccurs="1" maxOccurs="1" />
               <xs:element name="category" type="x3:categoryReference"
280                 minOccurs="1" maxOccurs="1" />
             </xs:choice>
             <xs:element name="utility" type="xs:double"
                 minOccurs="1" maxOccurs="1" />
           </xs:sequence>
         </xs:complexType>
285       </xs:element>
     </xs:sequence>
   </xs:extension>
 </xs:complexContent>
290 </xs:complexType>

<xs:complexType name="directUtilityCriterionSetType">
  <xs:sequence>
    <xs:element name="criterion" type="x3:directUtilityCriterionType"
295     minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

<!-- NominalUtilityCriterion -->
300 <xs:complexType name="nominalUtilityCriterionType">
  <xs:complexContent>
    <xs:extension base="x3:criterionType">
      <xs:sequence>
        <xs:sequence minOccurs="1" maxOccurs="unbounded">
305         <xs:element name="category" type="x3:categoryReference" />
         <xs:element name="utility" type="xs:double" />
        </xs:sequence>
      </xs:sequence>
    </xs:extension>
310 </xs:complexContent>
  </xs:complexType>

<xs:complexType name="nominalUtilityCriterionSetType">
  <xs:sequence>
315   <xs:element name="criterion" type="x3:nominalUtilityCriterionType"
     minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

320 <!-- CardinalUtilityCriterion -->
<xs:complexType name="cardinalUtilityCriterionType">
  <xs:complexContent>
    <xs:extension base="x3:criterionType">
325     <xs:sequence>
       <xs:element name="utilityFunction" type="x3:functionType" />
     </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

330 <xs:complexType name="cardinalUtilityCriterionSetType">
  <xs:sequence>
    <xs:element name="criterion" type="x3:cardinalUtilityCriterionType"
335     minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

<!-- DirectedCriterion -->
340 <xs:complexType name="directedCriterionType">
  <xs:complexContent>
    <xs:extension base="x3:criterionType">
      <xs:sequence>
        <xs:element name="preferenceDirection" minOccurs="1"
345         maxOccurs="1">
          <xs:simpleType>
            <xs:restriction base="xs:string">
              <xs:enumeration value="ascending" />
              <xs:enumeration value="descending" />
            </xs:restriction>
          </xs:simpleType>
350        </xs:element>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
355 </xs:complexType>
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<xs:complexType name="directedCriterionSetType">
  <xs:sequence>
    <xs:element name="criterion" type="x3:directedCriterionType"
360     minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

<!-- OutrankingCriterion -->
365 <xs:complexType name="outrankingCriterionType">
  <xs:complexContent>
    <xs:extension base="x3:directedCriterionType">
      <xs:sequence>
        <!-- The thresholds should be composed of non-negative a and b -->
370 <xs:element name="indifferenceThreshold" type="x3:affineLinearFunctionType"
          minOccurs="0" maxOccurs="1" />
        <xs:element name="preferenceThreshold" type="x3:affineLinearFunctionType"
          minOccurs="0" maxOccurs="1" />
375 <xs:element name="vetoThreshold" type="x3:affineLinearFunctionType"
          minOccurs="0" maxOccurs="1" />
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
380

<xs:complexType name="outrankingCriterionSetType">
  <xs:sequence>
    <xs:element name="criterion" type="x3:outrankingCriterionType"
385     minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

<!-- ValuedEntity -->
390 <xs:complexType name="valuedEntityType">
  <xs:sequence>
    <xs:element name="entity" type="x3:keyedEntityReference" />
    <xs:element name="measurement" type="x3:measurementType" />
  </xs:sequence>
</xs:complexType>
395

<xs:complexType name="valuedEntitySetType">
  <xs:sequence>
    <xs:element name="entry" type="x3:valuedEntityType"
400     minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

<!-- ExactValuedEntity -->
405 <xs:complexType name="exactValuedEntityType">
  <xs:sequence>
    <xs:element name="entity" type="x3:keyedEntityReference" />
    <xs:element name="measurement" type="x3:exactMeasurementType" />
  </xs:sequence>
410 </xs:complexType>

<xs:complexType name="exactValuedEntitySetType">
  <xs:sequence>
    <xs:element name="entry" type="x3:exactValuedEntityType"
415     minOccurs="0" maxOccurs="unbounded" />
  </xs:sequence>
</xs:complexType>

<!-- ValuedPair -->
420 <xs:complexType name="anyValuedPairType">
  <xs:sequence>
    <xs:element name="from" type="x3:keyedEntityReference" />
    <xs:element name="to" type="x3:keyedEntityReference" />
    <xs:element name="measurement" type="x3:measurementType" />
425 </xs:sequence>
</xs:complexType>

<!-- ValuedRelation -->
430 <xs:complexType name="anyValuedRelationType">
  <xs:sequence>
    <xs:element name="valuedPair" minOccurs="0" maxOccurs="unbounded"
      type="x3:anyValuedPairType" />
  </xs:sequence>
</xs:complexType>
435

<!-- BinaryValuedPair -->
<xs:complexType name="binaryValuedPairType">
  <xs:sequence>
    <xs:element name="from" type="x3:keyedEntityReference" />
    <xs:element name="to" type="x3:keyedEntityReference" />
440 <xs:element name="measurement" type="x3:binaryMeasurementType"
      minOccurs="0" maxOccurs="1">
      <xs:annotation>
        <xs:documentation>If not present, the measurement is interpreted as
445         if it had a value equals to true. It is recommended, though not

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        mandatory, to only use this feature when the false values are
        skipped.
    </xs:documentation>
    </xs:annotation>
450 </xs:element>
    </xs:sequence>
</xs:complexType>

<!-- BinaryValuedRelation -->
455 <xs:complexType name="binaryRelationType">
    <xs:sequence>
        <!-- If this binary relation is supposed to be known over some set of
        pairs, then it is allowed (though not mandatory) to skip some pairs, that
        is, to have no binaryValuedPair representing some pairs. Those pairs will
460 be interpreted as if they had been included with a value equal to false. -->
        <xs:element name="valuedPair" minOccurs="0" maxOccurs="unbounded"
            type="x3:binaryValuedPairType" />
    </xs:sequence>
</xs:complexType>

465 <!-- ExactValuedPair -->
<xs:complexType name="valuedPairType">
    <xs:sequence>
        <xs:element name="from" type="x3:keyedEntityReference" />
470 <xs:element name="to" type="x3:keyedEntityReference" />
        <xs:element name="measurement" type="x3:exactMeasurementType" />
    </xs:sequence>
</xs:complexType>

475 <!-- ExactValuedRelation -->
<xs:complexType name="valuedRelationType">
    <xs:annotation>
        <xs:documentation>To encode a relation over sets  $A \times B$ , with  $A, B$  in
        {alternative set, attribute set, criterion set, category set},  $A \neq$ 
480  $B$ , two possibilities exist as the from and to may be inverted.
        Please use as from type the one coming first in the list
        [alternative set, attribute set, criterion set, category set]. Note
        this also holds for other valued relations.
    </xs:documentation>
    </xs:annotation>
    <xs:sequence>
        <xs:element name="valuedPair" minOccurs="0" maxOccurs="unbounded"
            type="x3:valuedPairType" />
    </xs:sequence>
490 </xs:complexType>

    <xs:complexType name="intervalValuedPairType">
        <xs:sequence>
            <xs:element name="from" type="x3:keyedEntityReference" />
495 <xs:element name="to" type="x3:keyedEntityReference" />
            <xs:element name="measurement" type="x3:intervalType" />
        </xs:sequence>
    </xs:complexType>

500 <xs:complexType name="intervalValuedRelationType">
    <xs:sequence>
        <xs:element name="valuedPair" minOccurs="0" maxOccurs="unbounded"
            type="x3:intervalValuedPairType" />
    </xs:sequence>
505 </xs:complexType>

    <xs:complexType name="gaussianValuedPairType">
        <xs:sequence>
            <xs:element name="from" type="x3:keyedEntityReference" />
510 <xs:element name="to" type="x3:keyedEntityReference" />
            <xs:element name="measurement" type="x3:gaussianType" />
        </xs:sequence>
    </xs:complexType>

515 <xs:complexType name="gaussianValuedRelationType">
    <xs:sequence>
        <xs:element name="valuedPair" minOccurs="0" maxOccurs="unbounded"
            type="x3:gaussianValuedPairType" />
    </xs:sequence>
520 </xs:complexType>

    <xs:complexType name="nominalValuedPairType">
        <xs:sequence>
            <xs:element name="from" type="x3:keyedEntityReference" />
525 <xs:element name="to" type="x3:keyedEntityReference" />
            <xs:element name="measurement" type="x3:nominalMeasurementType" />
        </xs:sequence>
    </xs:complexType>

530 <xs:complexType name="nominalValuedRelationType">
    <xs:sequence>
        <xs:element name="valuedPair" minOccurs="0" maxOccurs="unbounded"
            type="x3:nominalValuedPairType" />
    </xs:sequence>
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535 </xs:complexType>
    <xs:complexType name="impreciseNominalValuedPairType">
      <xs:sequence>
        <xs:element name="from" type="x3:keyedEntityReference" />
540     <xs:element name="to" type="x3:keyedEntityReference" />
        <xs:element name="measurement" type="x3:impreciseNominalMeasurementType" />
      </xs:sequence>
    </xs:complexType>

545 <xs:complexType name="impreciseNominalValuedRelationType">
  <xs:sequence>
    <xs:element name="valuedPair" minOccurs="0" maxOccurs="unbounded"
      type="x3:impreciseNominalValuedPairType" />
  </xs:sequence>
550 </xs:complexType>
</xs:schema>
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