Univerza *v Ljubljani*
Fakulteta *za računalništvo in informatiko*

Uvod v računalništvo

Vaje 9

6. – 10. 12. 2021

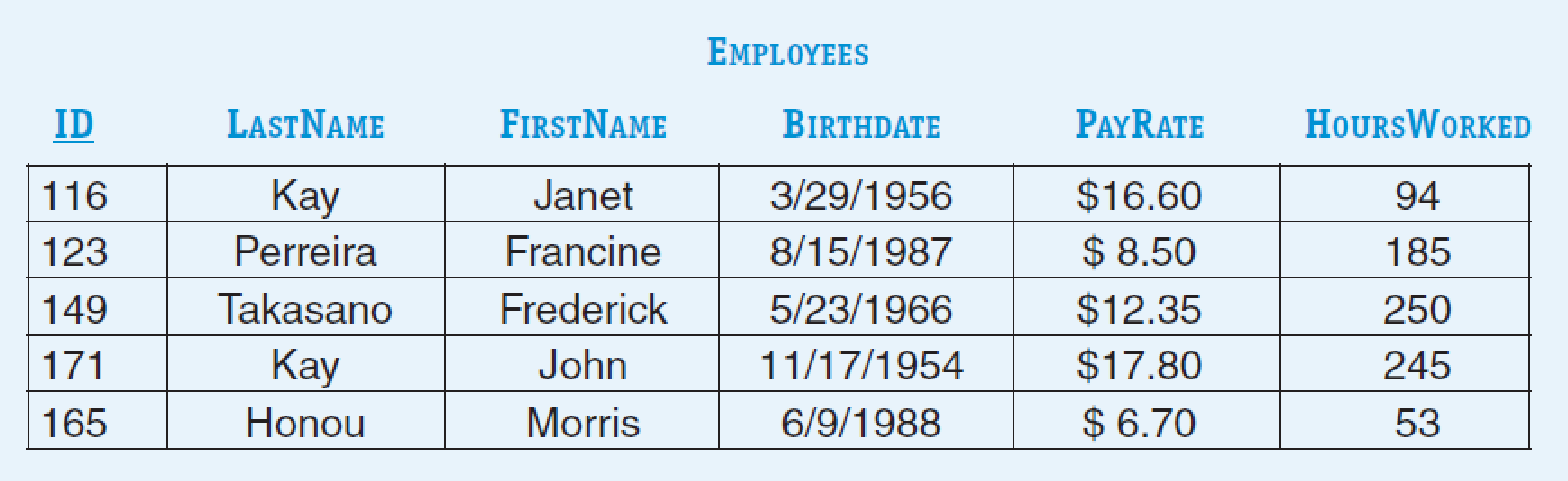
Podatkovne baze

- Shranjevanje in upravljanje velike količine podatkov
- Podatke lahko predstavimo v obliki relacij
  - osnova za poizvedovalne jezike (npr. SQL)
  - relacije povezujejo atribute (stolpci) z objekti (vrstice)
  - si lahko predstavljamo kot 2D tabelo
- Vsak objekt opišemo z n-terico atributov

Ključi

- Relacija je množica → vsaka vrstica je unikatna
- Ključ: minimalna podmnožica atributov, ki enolično določa vrstico
- Atribute, ki so del ključa, <u>podčrtamo</u>

Relacija Employees



EMPLOYEES

ID	LASTNAME	FIRSTNAME	BIRTHDATE	PAYRATE	HOURSWORKED
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53

SQL (Structured Query Language)

Upravljanje s podatki

- INSERT INTO relacija
  VALUES n-terka;
- UPDATE relacija
  SET atribut1=vrednost1…
  WHERE pogoj;
- DELETE FROM relacija WHERE pogoj;

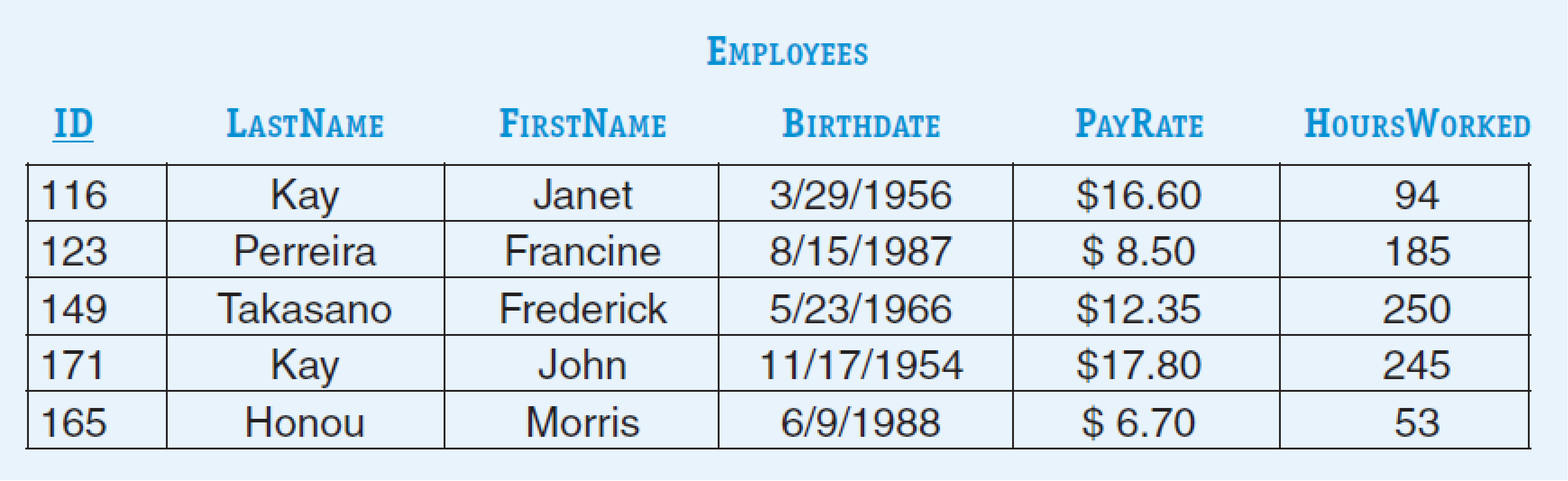
Poizvedovanje

- SELECT atributi
  FROM relacija
  WHERE pogoj
  ORDER BY atributi ASC|DESC; (privzeto naraščajoče)

Poizvedovanje - primeri

```
SELECT ID, LastName, FirstName,
Birthdate, PayRate, HoursWorked
FROM Employees
WHERE ID = 123;
```

```
SELECT *
FROM Employees
WHERE ID = 123;
```



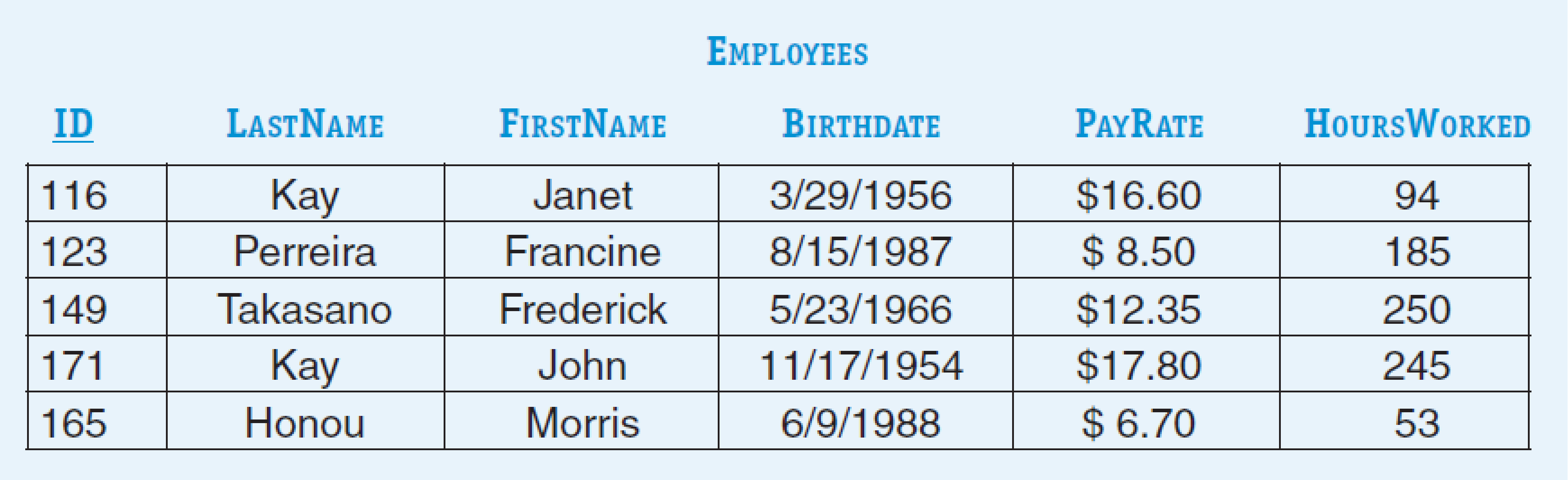
EMPLOYEES

ID	LASTNAME	FIRSTNAME	BIRTHDATE	PAYRATE	HOURSWORKED
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53

Poizvedovanje - primeri

```
SELECT *
FROM Employees
ORDER BY ID;
```

```
SELECT *
FROM Employees
WHERE PayRate > 15.00;
```



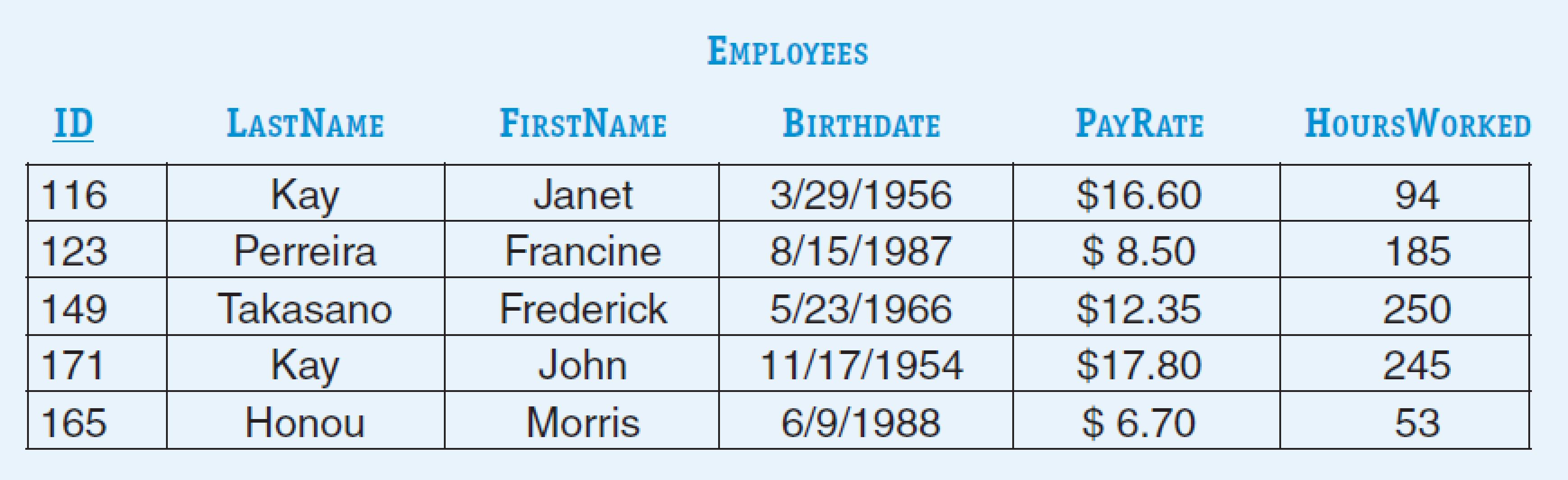
EMPLOYEES

ID	LASTNAME	FIRSTNAME	BIRTHDATE	PAYRATE	HOURSWORKED
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53

Naloga 9.1

Kaj je rezultat spodnje poizvedbe?

SELECT FirstName
FROM Employees
WHERE LastName = ‘Kay’



EMPLOYEES

ID	LASTNAME	FIRSTNAME	BIRTHDATE	PAYRATE	HOURSWORKED
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53

Naloga 9.1 - rešitev

Kaj je rezultat spodnje poizvedbe?

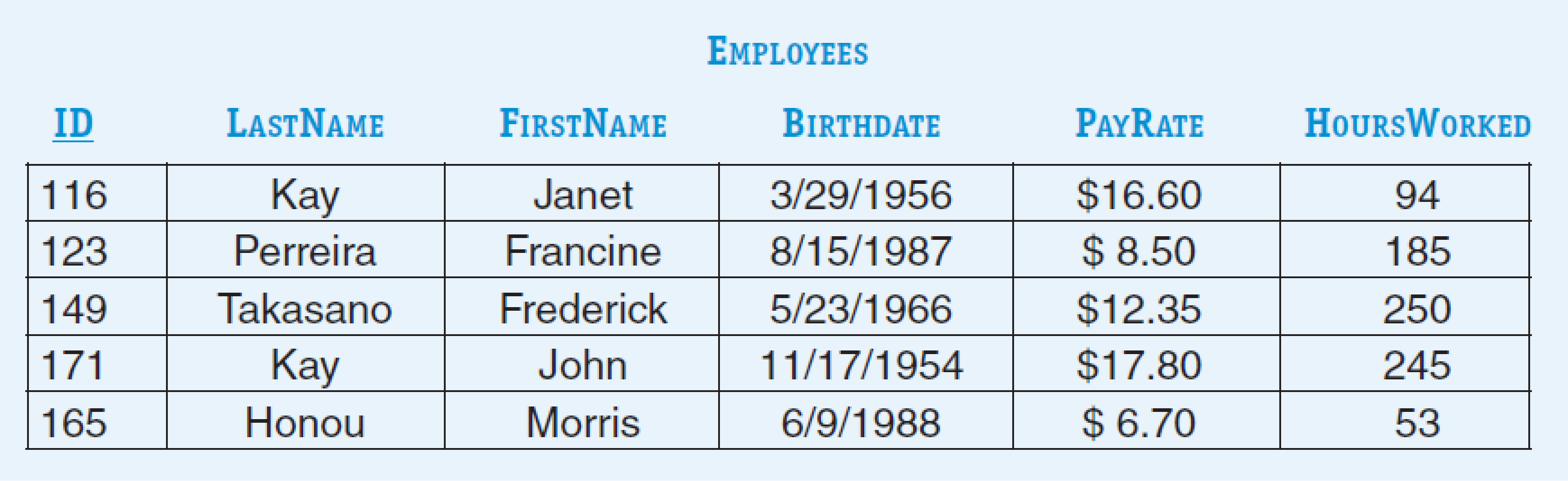
```
SELECT FirstName
FROM Employees
WHERE LastName = ‘KAY’
```

FirstName
Janet
John

Naloga 9.2

Kaj je rezultat spodnje poizvedbe?

```
SELECT ID, PayRate
FROM Employees
WHERE LastName = ‘Takasano’;
```



Employees

ID	LastName	FirstName	BirthDate	PayRate	HoursWorked
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53

Naloga 9.2 - rešitev

Kaj je rezultat spodnje poizvedbe?

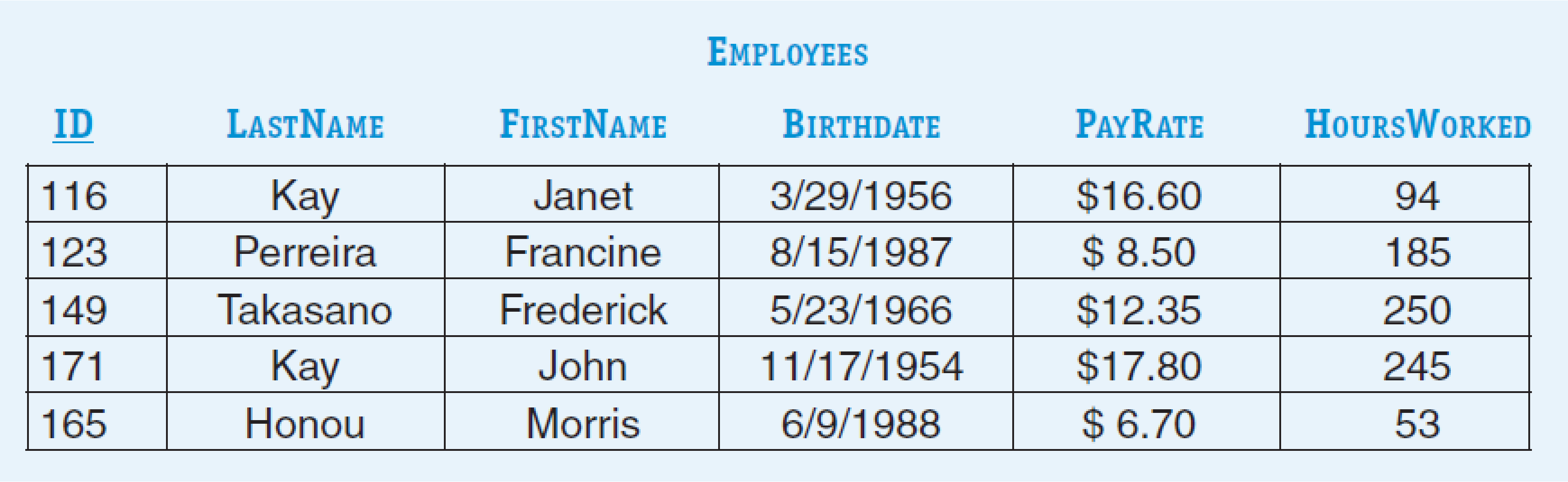
```
SELECT ID, PayRate
FROM Employees
WHERE LastName = ‘Takasano’;
```

ID	PayRate
149	$12.35

Naloga 9.3

Kaj je rezultat spodnje poizvedbe?

```
SELECT *
FROM Employees
WHERE HoursWorked < 100;
```



EMPLOYEES

ID	LastName	FirstName	BirthDate	PayRate	HoursWorked
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53

Naloga 9.3 - rešitev

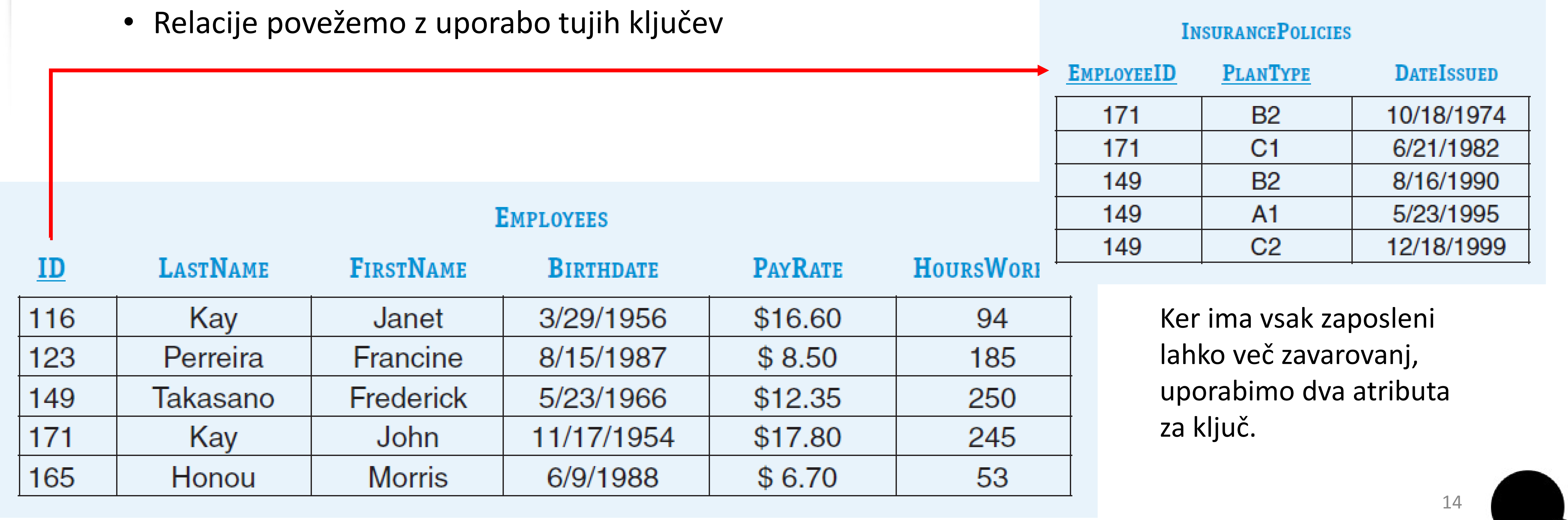
Kaj je rezultat spodnje poizvedbe?

```
SELECT *
FROM Employees
WHERE HoursWorked < 100;
```

ID	LastName	FirstName	Birthdate	PayRate	HoursWorked
116	Kay	Janet	3/29/1956	$16.60	94
165	Honou	Morris	6/9/1988	$6.70	53

Povezovanje relacij

- Kadar imamo več relacij, jih lahko povežemo preko skupnih atributov.
- Relacije povežemo z uporabo tujih ključev



InsurancePolicies

EmployeeID	PlanType	DateIssued
171	B2	10/18/1974
171	C1	6/21/1982
149	B2	8/16/1990
149	A1	5/23/1995
149	C2	12/18/1999

Employees

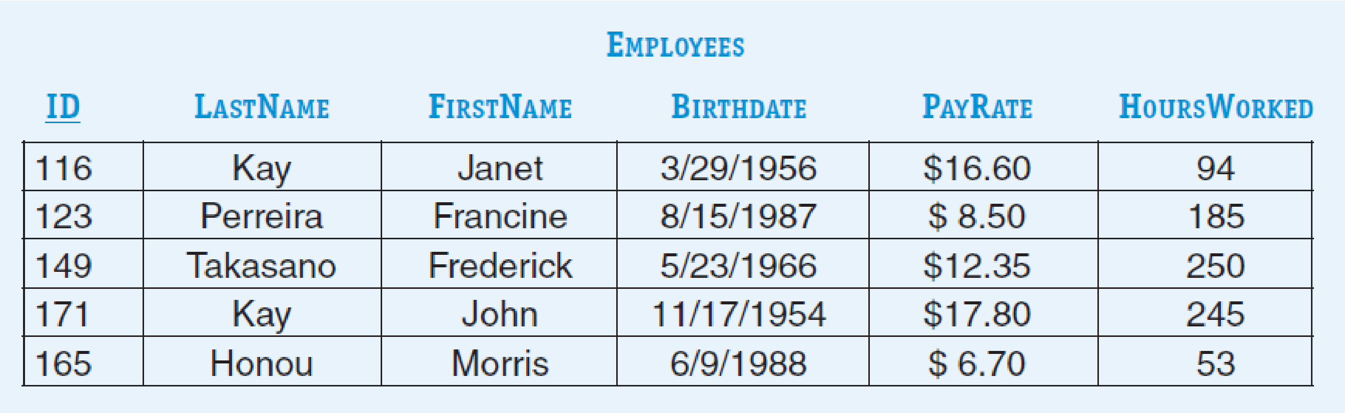
ID	LastName	FirstName	BirthDate	PayRate	HoursWor
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53

Ker ima vsak zaposleni lahko več zavarovanj, uporabimo dva atributa za ključ.

Naloga 9.4

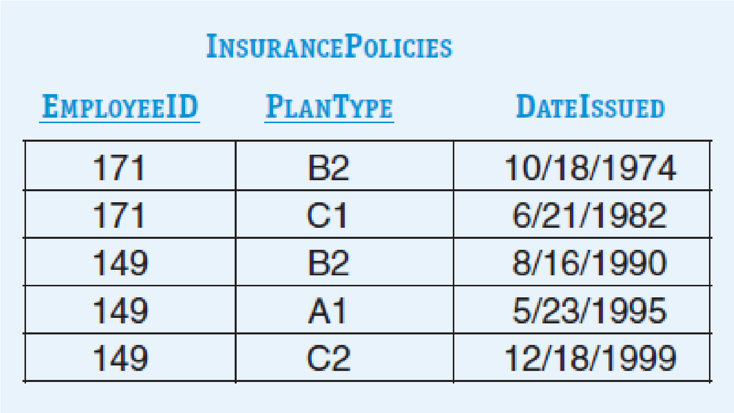
Kaj je rezultat spodnje poizvedbe? (Znak # dovoljuje, da se datum uporabi kot število.)

```
SELECT ID, PlanType
FROM Employees, InsurancePolicies
WHERE Birthdate > #1/01/1960#
AND ID = EmployeeID;
```



EMPLOYEES

ID	LASTNAME	FIRSTNAME	BIRTHDATE	PAYRATE	HOURSWORKED
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53



INSURANCEPOLICIES

EMPLOYEEID	PLANTYPE	DATEISSUED
171	B2	10/18/1974
171	C1	6/21/1982
149	B2	8/16/1990
149	A1	5/23/1995
149	C2	12/18/1999

Naloga 9.4 - rešitev

Kaj je rezultat spodnje poizvedbe? (Znak # dovoljuje, da se datum uporabi kot število.)

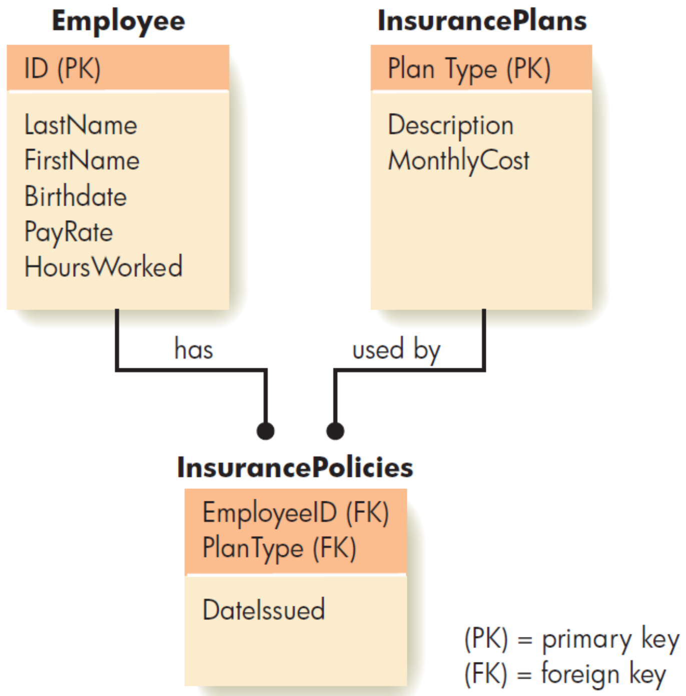
```
SELECT ID, PlanType
FROM Employees, InsurancePolicies
WHERE Birthdate > #1/01/1960#
AND ID = EmployeeID;
```

ID	PlanType
149	B2
149	A1
149	C2

Naloga 9.5

Dopolnite sledečo SQL poizvedbo, da vrne mesečni strošek zavaravonja Fredericka Takasana; ker je PlanType atribute v dveh relacijah, moramo vključiti tudi ime relacije.

SELECT LastName, FirstName, _____
FROM Employees, InsurancePlans, InsurancePolicies
WHERE LastName = _____
AND ID = EmployeeID
AND InsurancePolicies.PlanType = _____;



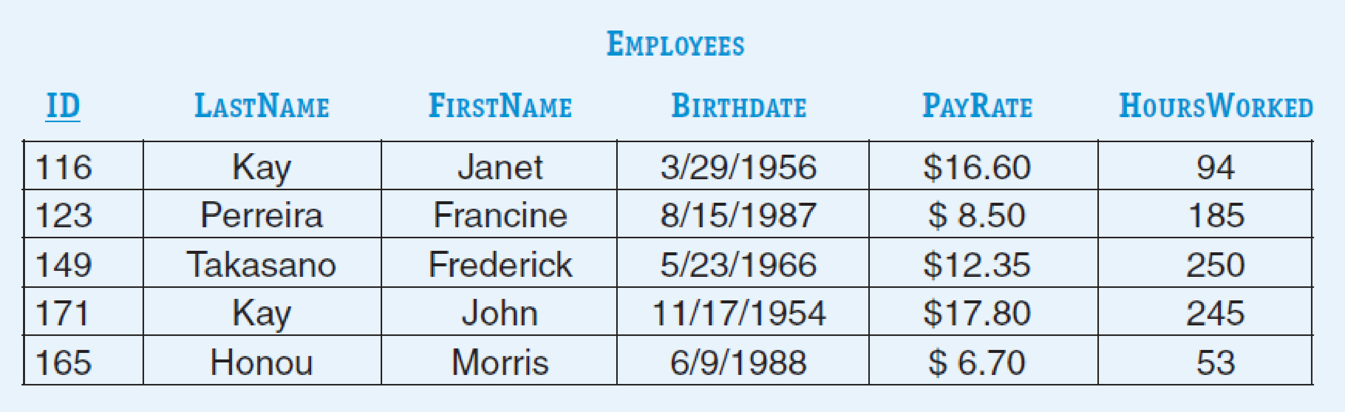
Naloga 9.5 - rešitev

Dopolnite sledečo SQL poizvedbo, da vrne mesečni strošek zavaravonj Fredericka Takasana; ker je PlanType atribute v dveh relacijah, moramo vključiti tudi ime relacije.

```
SELECT LastName, FirstName, MonthlyCost
FROM Employees, InsurancePlans, InsurancePolicies
WHERE FirstName = Frederick AND LastName = Takasano
AND ID = EmployeeID
AND InsurancePolicies.PlanType = InsurancePlans.PlanType;
```

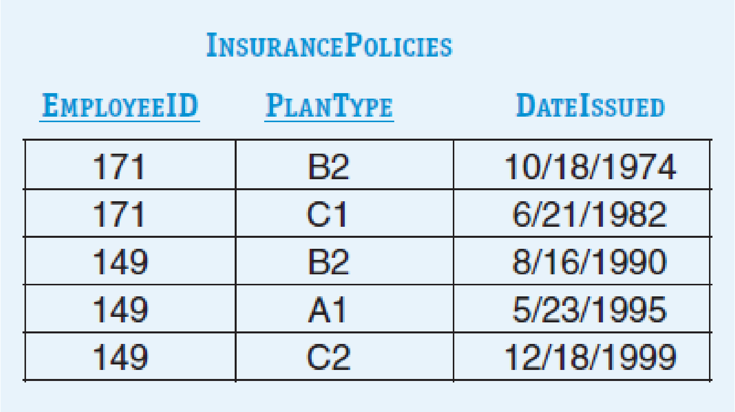
Naloga 9.6

Napišite poizvedbo, ki vrne imena in priimke vseh zaposlenih, ki imajo zavarovanje tipa B2.



Employees

ID	LastName	FirstName	BirthDate	PayRate	HoursWorked
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53



InsurancePolicies

EmployeeID	PlanType	DateIssued
171	B2	10/18/1974
171	C1	6/21/1982
149	B2	8/16/1990
149	A1	5/23/1995
149	C2	12/18/1999

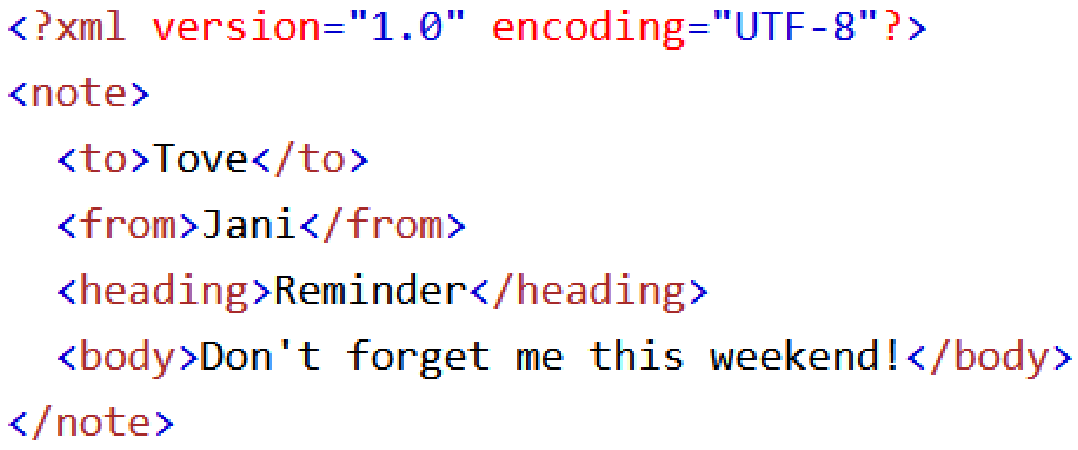
Naloga 9.6 - rešitev

Napišite poizvedbo, ki vrne imena in priimke vseh zaposlenih, ki imajo zavarovanje tipa B2.

```
SELECT FirstName, LastName
FROM Employees, InsurancePlans
WHERE ID = EmployeeID
AND PlanType = B2;
```

XML

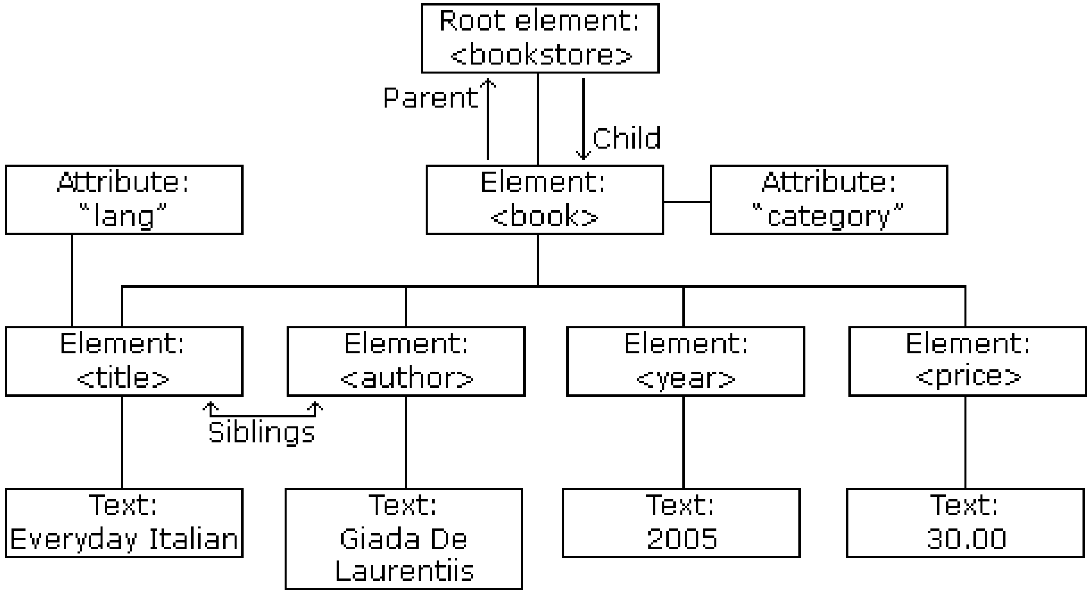
- eXtensible Markup Language
- za shranjevanje in prenos podatkov
- razumljiv za ljudi in stroje
- nima informacije o prikazu podatkov
- značke niso vnaprej določene



```
<?xml version="1.0" encoding="UTF-8"?>
<note>
  <to>Tove</to>
  <from>Jani</from>
  <heading>Reminder</heading>
  <body>Don't forget me this weekend!</body>
</note>
```

XML drevo

Drevesna struktura: od korena do listov



Root element:
<bookstore>

Parent

Child

Attribute:
"lang"

Element:
<book>

Attribute:
"category"

Element:
<title>

Element:
<author>

Element:
<year>

Element:
<price>

Siblings

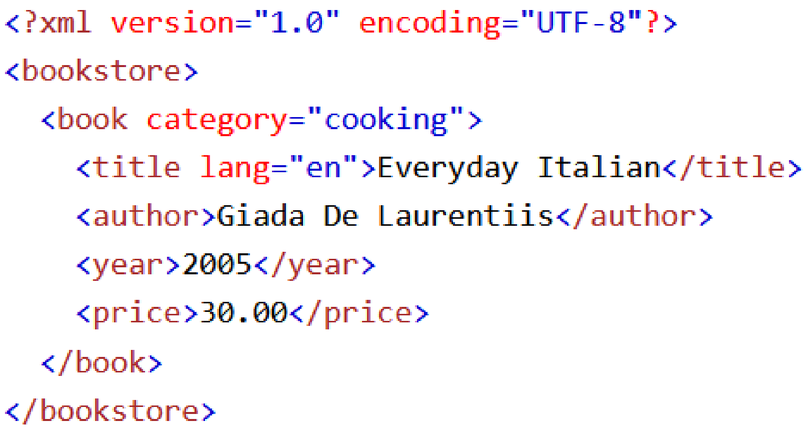
Text:
Everyday Italian

Text:
Giada De
Laurentiis

Text:
2005

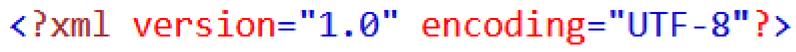
Text:
30.00

↔



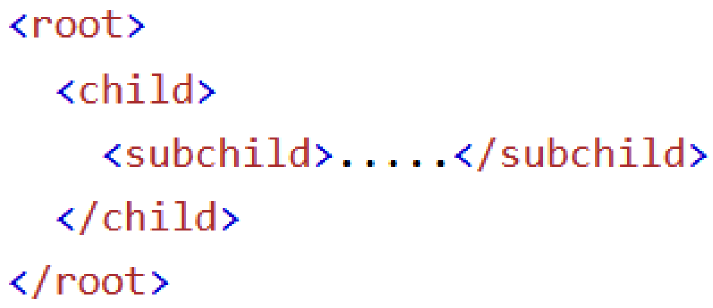
```
<?xml version="1.0" encoding="UTF-8"?>
<bookstore>
  <book category="cooking">
    <title lang="en">Everyday Italian</title>
    <author>Giada De Laurentiis</author>
    <year>2005</year>
    <price>30.00</price>
  </book>
</bookstore>
```

XML sintaksa



```
<?xml version="1.0" encoding="UTF-8"?>
```

- opcijsko deklaracija na začetku dokumenta
- XML dokumenti vsebujejo en korenski element
- ostali elementi so znotraj korenskega elementa
- vsi elementi morajo imeti zaključno oznako
- razlikuje med malimi in velikimi črkami
- elementi morajo biti pravilno gnezdeni
- vrednosti atributov so v navednicah



```
<root>
  <child>
    <subchild>.....</subchild>
  </child>
</root>
```

Naloga 9.7

Napišite XML dokument, ki vsebuje podatke o študentih.

Dokument predstavite še z drevesno sliko.

Naloga 9.7 - rešitev

Napišite XML dokument, ki vsebuje podatke o študentih.
Dokument predstavite še z drevesno sliko.

```
<udelezenci>
   <student vpisna="1234567">
      <ime>Janez</ime>
      <priimek>Novak</ime>
   </student>
</udelezenci>
```

Naloga 9.8

XML dokument iz prejšnje naloge spremenite tako, da bodo vsi podatki v atributih.

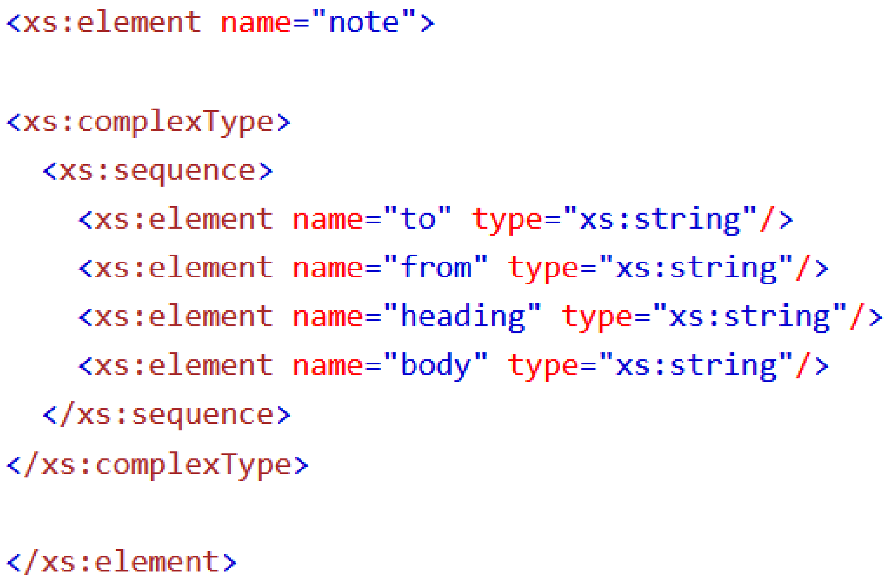
Naloga 9.8 - rešitev

XML dokument iz prejšnje naloge spremenite tako, da bodo vsi podatki v atributih.

```
<udelezenci>
   <student vpisna="1234567" ime= ="Janez" priimek="Novak" />
</udelezenci>
```

XML shema

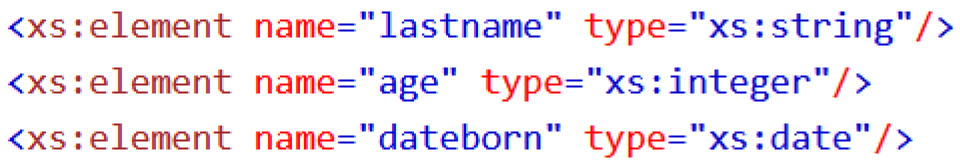
- Shema opisuje strukturo XML dokumenta
- Opis formata podatkov
- Definira elemente in njihove atribute
- Privzete vrednosti in možne vrednosti
- Lahko preverimo pravilnost XML dokumenta
- Nekaj podprtih podatkovnih tipov:
    - xs:string
    - xs:decimal
    - xs:integer
    - xs:boolean
    - xs:date
    - xs:time



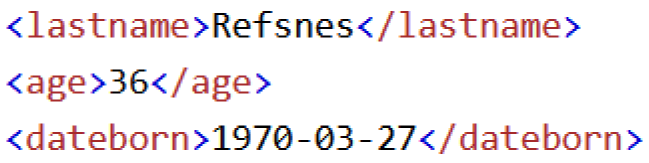
```
<xs:element name="note">

<xs:complexType>
  <xs:sequence>
    <xs:element name="to" type="xs:string"/>
    <xs:element name="from" type="xs:string"/>
    <xs:element name="heading" type="xs:string"/>
    <xs:element name="body" type="xs:string"/>
  </xs:sequence>
</xs:complexType>

</xs:element>
```

XML shema

- Korenski element vsake sheme je <schema>
- Enostavni elementi vsebujejo samo vrednost

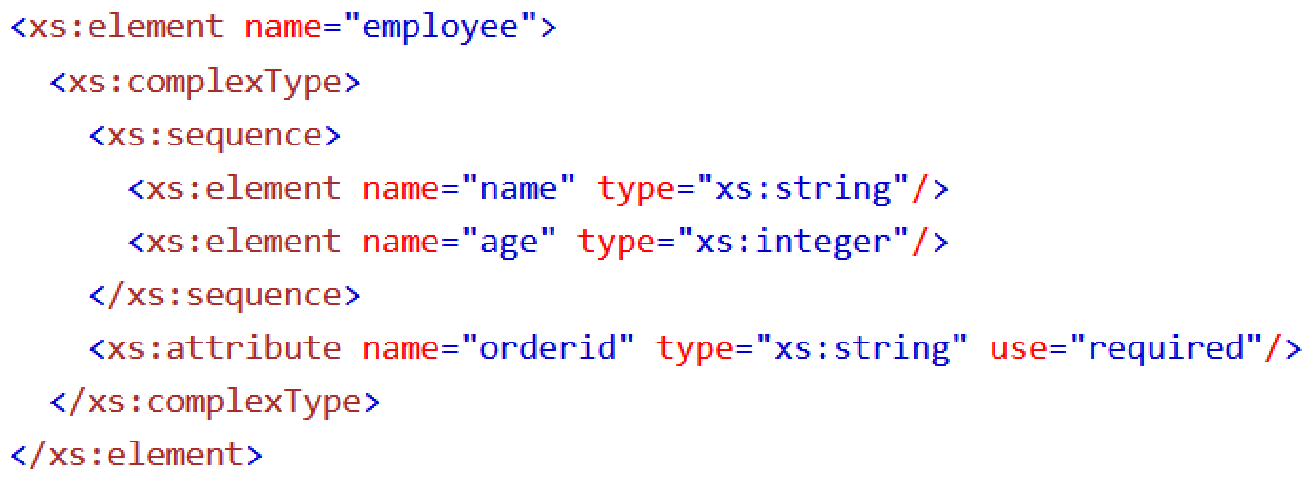


```
<xs:element name="lastname" type="xs:string"/>
<xs:element name="age" type="xs:integer"/>
<xs:element name="dateborn" type="xs:date"/>
```



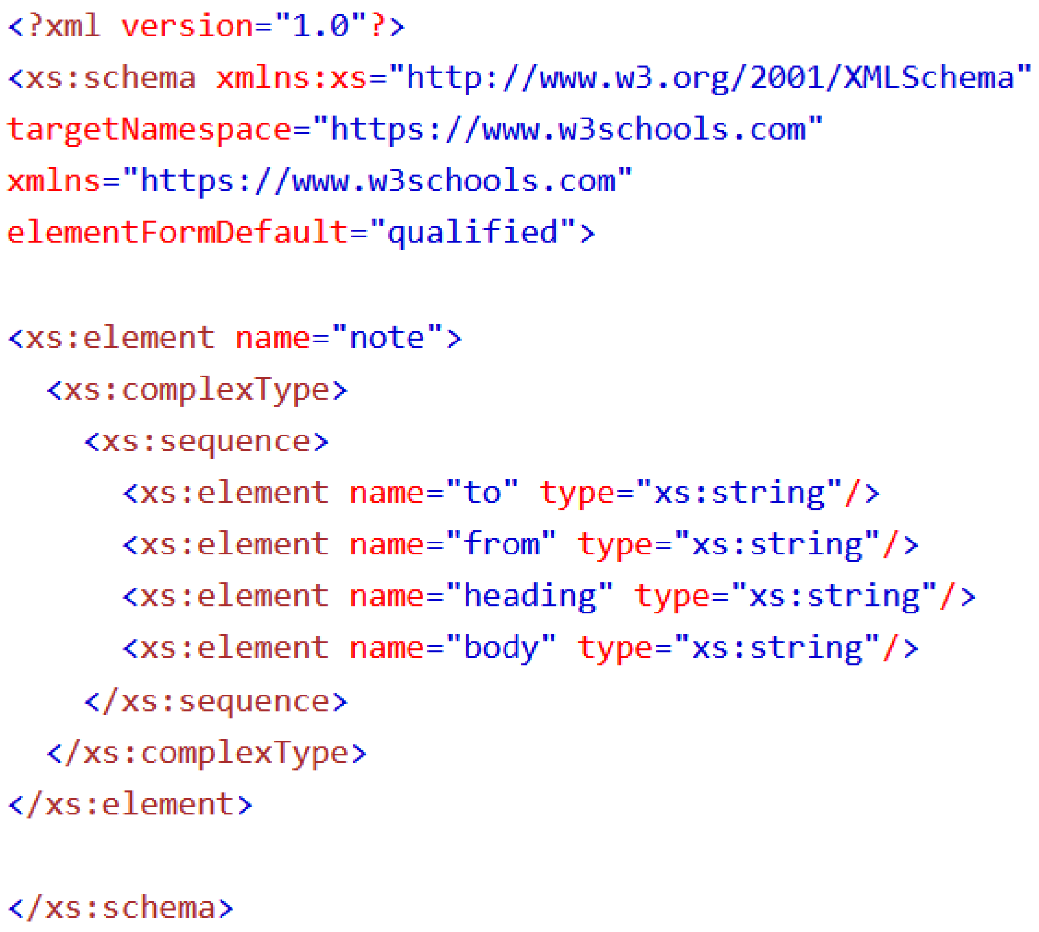
```
<lastname>Refsnes</lastname>
<age>36</age>
<dateborn>1970-03-27</dateborn>
```

- Kompleksni elementi lahko vsebujejo druge elemente ali atribute



```
<xs:element name="employee">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="name" type="xs:string"/>
      <xs:element name="age" type="xs:integer"/>
    </xs:sequence>
    <xs:attribute name="orderid" type="xs:string" use="required"/>
  </xs:complexType>
</xs:element>
```

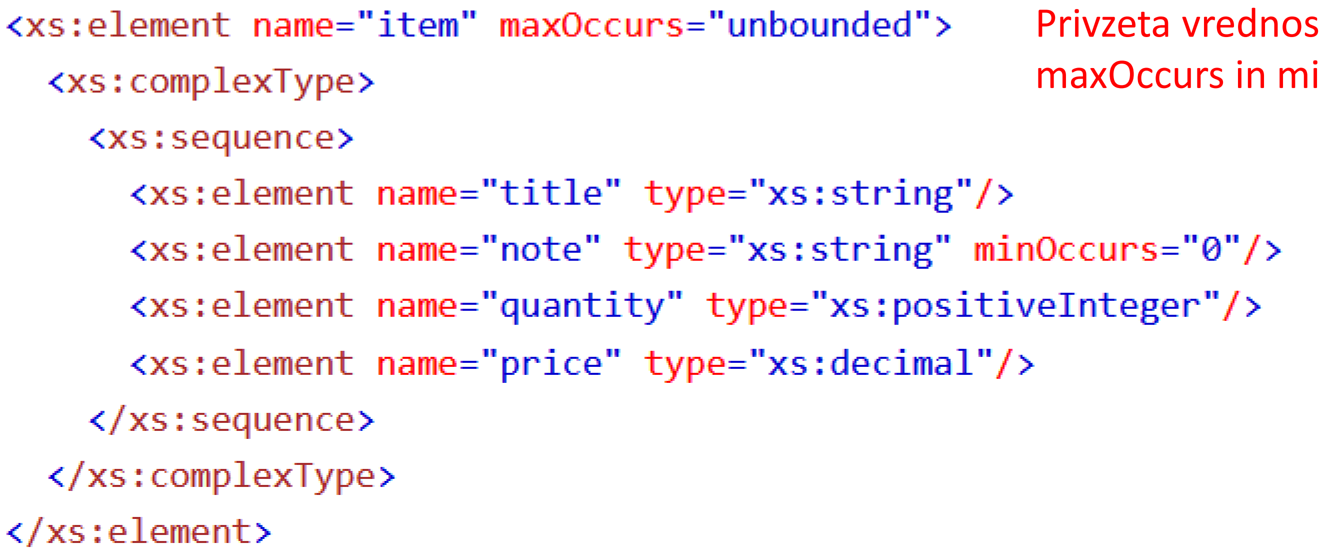
XML shema



```
<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="https://www.w3schools.com"
xmlns="https://www.w3schools.com"
elementFormDefault="qualified">

<xs:element name="note">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="to" type="xs:string"/>
      <xs:element name="from" type="xs:string"/>
      <xs:element name="heading" type="xs:string"/>
      <xs:element name="body" type="xs:string"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>

</xs:schema>
```

Naloga 9.9

Opišite element, ki ga določa sledeči del sheme.
Napišite primer XML dokumenta, ki vsebuje ta element.



```
<xs:element name="item" maxOccurs="unbounded">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="title" type="xs:string"/>
      <xs:element name="note" type="xs:string" minOccurs="0"/>
      <xs:element name="quantity" type="xs:positiveInteger"/>
      <xs:element name="price" type="xs:decimal"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Privzeta vrednost za
maxOccurs in minOccurs je 1!

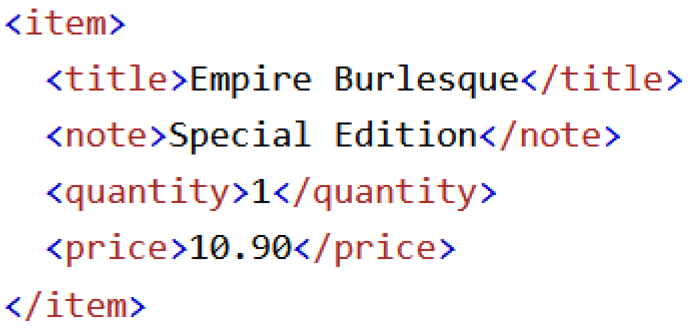
Naloga 9.9 - rešitev

Opišite element, ki ga določa sledeči del sheme.

Napišite primer XML dokumenta, ki vsebuje ta element.

Imamo lahko poljubno število elementov <item>, ki je kompleksen element. Sestavljen je iz štirih elementov:

- title: tipa string
- note: tipa string, lahko ga ni
- quantity: pozitivno celo število
- price: decimalno število



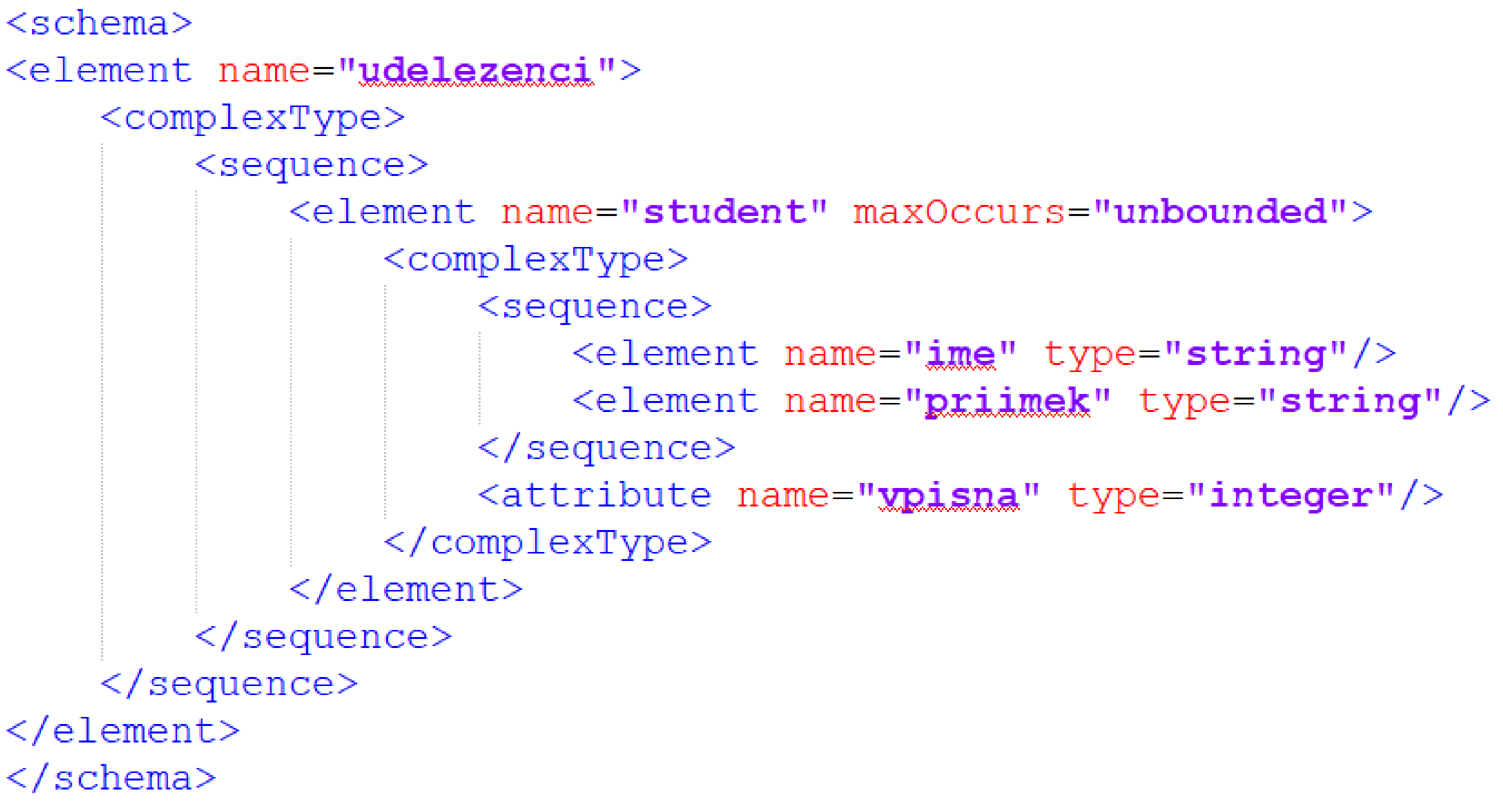
```
<item>
  <title>Empire Burlesque</title>
  <note>Special Edition</note>
  <quantity>1</quantity>
  <price>10.90</price>
</item>
```

Naloga 9.10

Napišite XML shemo za XML dokument, ki ste ga ustvarili pri prejšnjih nalogah.

Naloga 9.10 - rešitev

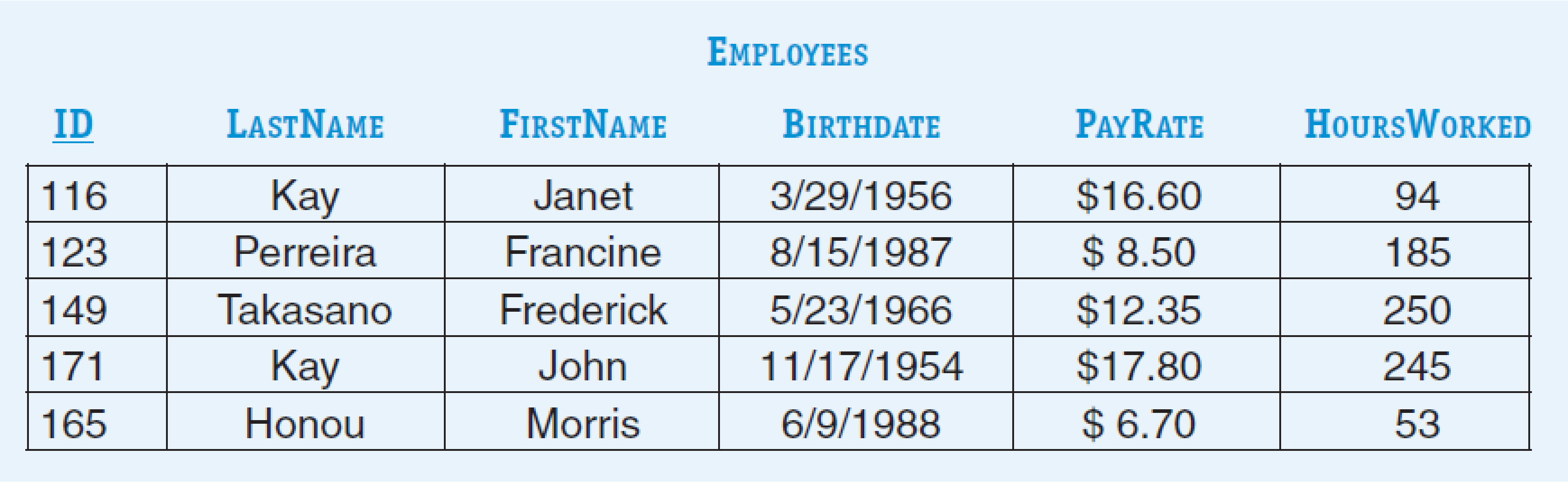
Napišite XML shemo za XML dokument, ki ste ga ustvarili pri prejšnjih nalogah.



```
<schema>
<element name="udelezenci">
    <complexType>
        <sequence>
            <element name="student" maxOccurs="unbounded">
                <complexType>
                    <sequence>
                        <element name="ime" type="string"/>
                        <element name="priimek" type="string"/>
                    </sequence>
                    <attribute name="vpisna" type="integer"/>
                </complexType>
            </element>
        </sequence>
    </sequence>
</element>
</schema>
```

Dodatna naloga 1

Napišite poizvedbo, ki iz relacije Employees poišče priimke vseh zaposlenih, ki so opravili med 100 in 200 ur (vključujoče).

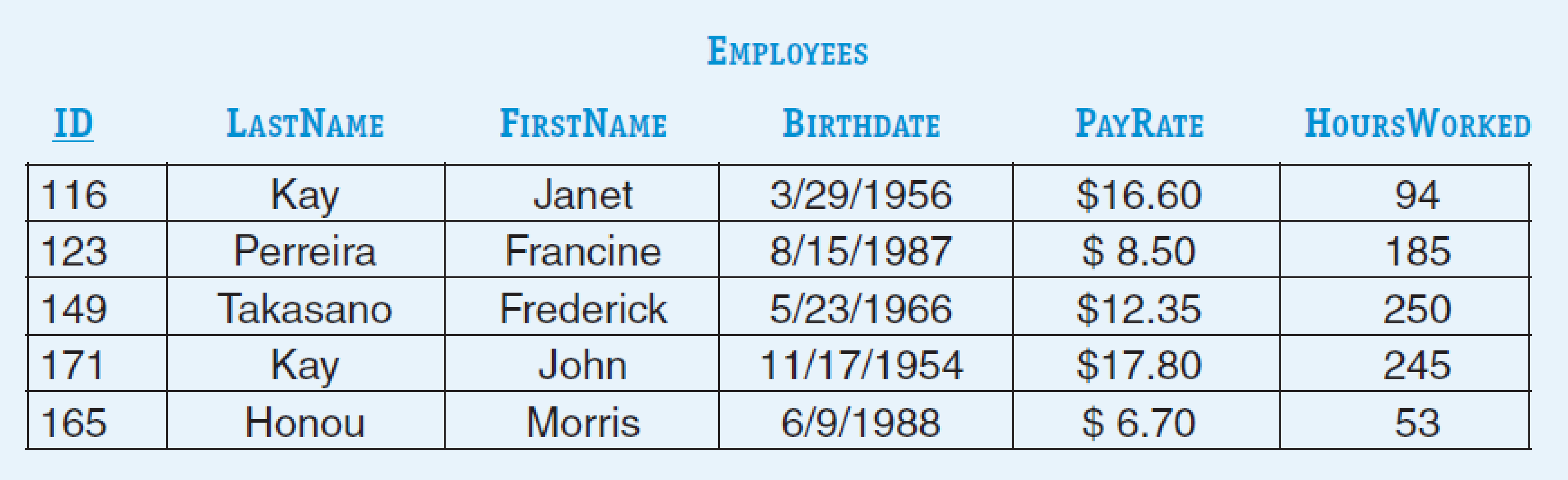


Employees

ID	LastName	FirstName	BirthDate	PayRate	HoursWorked
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53

Dodatna naloga 2

Napišite poizvedbo, ki vrne ime, priimek in plačo, urejeno po plači.

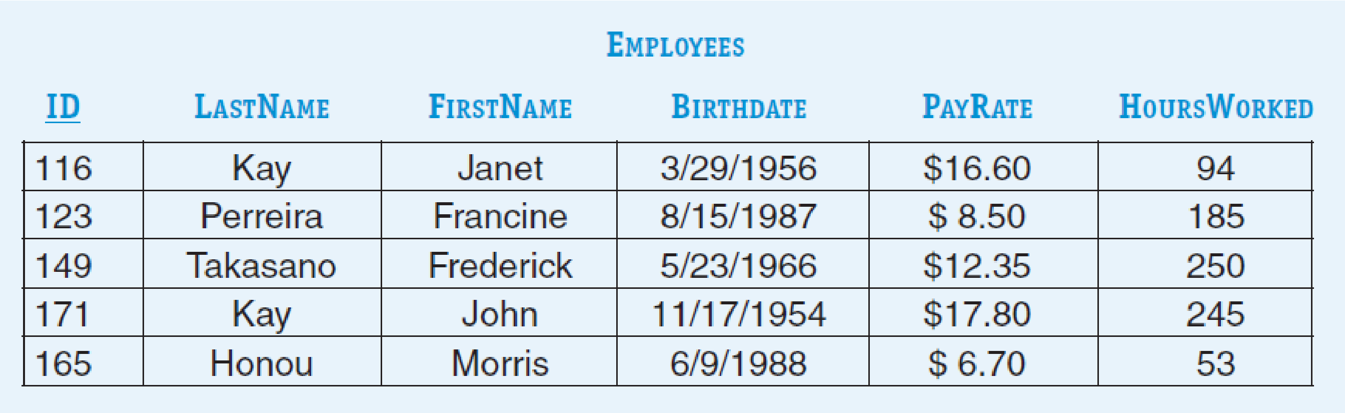


EMPLOYEES

ID	LASTNAME	FIRSTNAME	BIRTHDATE	PAYRATE	HOURSWORKED
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53

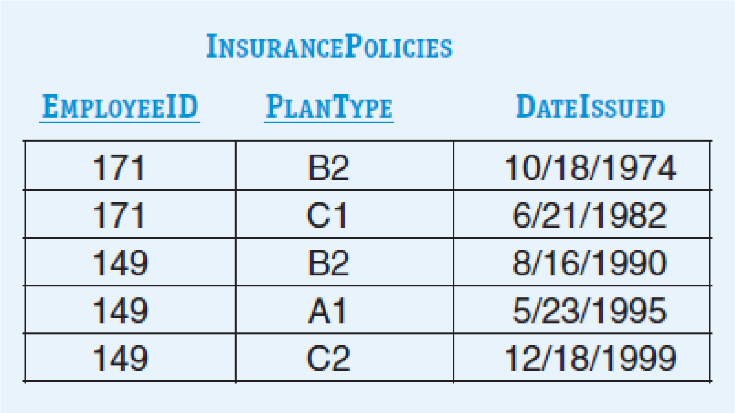
Dodatna naloga 3

Napišite poizvedbo, ki vrne ime, priimek, ure in tip zavarovanja za vse zaposlene, ki so delali manj kot 100 ur.



Employees

ID	LastName	FirstName	BirthDate	PayRate	HoursWorked
116	Kay	Janet	3/29/1956	$16.60	94
123	Perreira	Francine	8/15/1987	$ 8.50	185
149	Takasano	Frederick	5/23/1966	$12.35	250
171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53



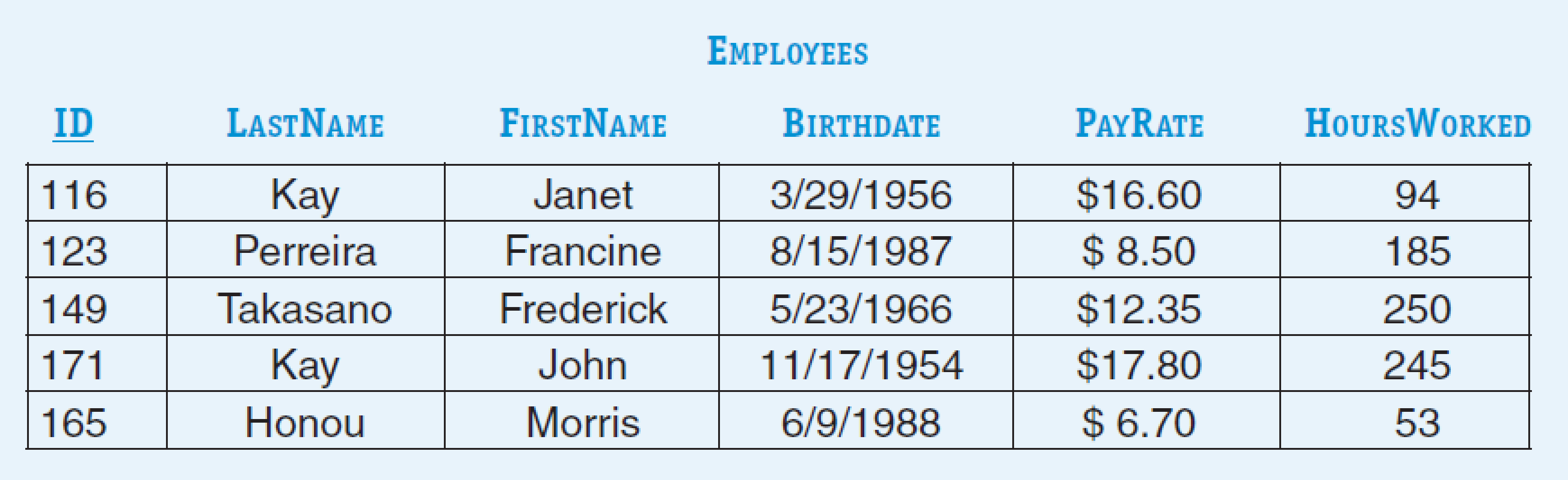
InsurancePolicies

EmployeeID	PlanType	DateIssued
171	B2	10/18/1974
171	C1	6/21/1982
149	B2	8/16/1990
149	A1	5/23/1995
149	C2	12/18/1999

Dodatna naloga 4

Ustvarite XML dokument, ki se uporabi za pošiljanje podatkov iz relacije Empleyees.

Napišite XML shemo, ki preverja pravilnost takih XML dokumentov.



Employees

ID	LastName	FirstName	BirthDate	PayRate	HoursWorked
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123	Perreira	Francine	8/15/1987	$ 8.50	185
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171	Kay	John	11/17/1954	$17.80	245
165	Honou	Morris	6/9/1988	$ 6.70	53