Report on Week 4

Lei Liu, 9669373

1. Task 1

1.1 Return names of countries that are not landlocked (i.e., have a sea coast).

```
select distinct c.name from country c join geo_sea s on c.code = s.country;
```

1.2 Return the names of all lakes, rivers and seas.

```
select name from lake UNION select name from river UNION select name from sea;
```

1.3 Return the average length over all the river.

```
select avg(length) from river;
```

1.4 Return the name of countries that have more than 10 islands.

```
select c.name from country c join geo_island i on c.code=i.country group by i.country having count(i.country) > 10;
```

1.5 Return, for every river in Great Britian, the length of that river.

```
select r.name, r.length from geo_river gr join river r on gr.river=r.name where gr.country='GB';
```

1.6 Return the name of the countries that have the 10 longest total length of rivers.

```
select name, sum(length) as total_length from (select distinct c.name, r.length from country c, geo_river gr, river r where c.code=gr.country and gr.river = r.name) group by name order by total_length desc limit 10;
```

1.7 Return all the information available about cities whose name is Manchester.

```
select * from City where name='Manchester';
```

1.8 Return the name of cities whose name starts with the substring 'Man'.

```
select name from city where name like 'Man%';
```

1.9 Return the name of the country and the name of the organization of countries with Buddhist populations that are members of organizations established after 1st December 1994.

```
select c.name as country, o.name from country c, organization o, ismember im, religion re where im.organization = o.abbreviation and c.code = im.country and re.country=c.code and o.established > '1994-12-01' and re.name = 'Buddhist';
```

1.10 Return the name of each country with the number of islands in it.

```
select c.name, count(geo.island) as num_island from country c join geo_island geo on c.code=geo.country group by geo.island;
```

2. Task 2

XQueries in task 2 is base on one file-mondial.xml.

2.1 Return the names of countries that are not landlocked (i.e., have a sea coast).

```
distinct-values(
for $c in doc('xml/mondial.xml')//country
let $code := $c/@car_code
for $geo_sea in doc('xml/mondial.xml')//sea/tokenize(@country)
where $code = $geo_sea
return $c/name )
```

2.2 Return the names of all lakes, rivers and seas.

```
let $l := doc('xml/mondial.xml')//lake/name/text()
let $r := doc('xml/mondial.xml')//river/name/text()
let $s := doc('xml/mondial.xml')//sea/name/text()
return $l union $r union $s
```

2.3 Return the average length over all the rivers in the database.

```
let $l := doc('xml/mondial.xml')//river/length/text()
return avg($l)
```

2.4 Return the name of countries that have more than 10 islands.

```
for $c in doc('xml/mondial.xml')//country
where
count(doc('xml/mondial.xml')//island[tokenize(@country)=$c/@car_code]/@id ) >
10
return $c/name/text()
```

2.5 Return, for every river in Great Britain, the length of that river.

```
for $r in doc('xml/mondial.xml')//river[tokenize(@country)='GB']
return $r/length
```

2.6 Return the name of the countries that have the 10 longest total length of rivers.

```
(for $c in doc('xml/mondial.xml')//country
let $l :=
sum(doc('xml/mondial.xml')//river[tokenize(@country)=$c/@car_code]/length/text()
)
order by $l descending
return concat($c/name, " ", $l)
)[position()<=10]
```

2.7 Return all the information available about cities whose name is Manchester.

```
doc('xml/mondial.xml')//city[name='Manchester']
```

2.8 Return the name of cities whose name starts with the substring 'Man’.

```
for $cn in doc('xml/mondial.xml')//city/name/text()
where starts-with( $cn, 'Man')
return $cn
```

2.9 Return the name of the country and the name of the organization of countries with Buddhist populations that are members of organizations established after 1st December 1994.

```
for $c in doc('xml/mondial.xml')//country[religion='Buddhist']
let $member := tokenize($c/@memberships)
for $o in doc('xml/mondial.xml')//organization[@id=$member and established >
'1994-12-01' ]
return concat($c/name, " ---- ", $o/name)
```

2.10 Return the name of each country with the number of islands in it.

```
for $c in doc('xml/mondial.xml')//country
let $num := count(doc('xml/mondial.xml')
//island[tokenize(@country)=$c/@car_code] )
return concat($c/name, " ", $num)
```

3. Task 3

3.1 Return the names of countries that are not landlocked (i.e., have a sea coast).

```
distinct-values(
for $c in doc('xml/converted/a/country_a.xml')//country-tuple
for $geo in doc('xml/converted/a/geo_sea_a.xml')//geo_sea-tuple
where $c/@code = $geo/@country
return $c/@name)
```

3.2 Return the names of all lakes, rivers and seas.

```
let $l := doc('xml/converted/a/lake_a.xml')//lake-tuple/@name
let $r := doc('xml/converted/a/river_a.xml')//river-tuple/@name
let $s := doc('xml/converted/a/sea_a.xml')//sea-tuple/@name
return $l union $r union $s
```

3.3 Return the average length over all the rivers in the database.

```
let $l := data( doc('xml/converted/a/river_a.xml')//river-tuple[@length !=
'MISSING']/@length )
return avg($l)
```

3.4 Return the name of countries that have more than 10 islands.

```
for $c in doc('xml/converted/a/country_a.xml')//country-tuple
where count( doc('xml/converted/a/geo_island_a.xml')//geo_island-
tuple[@country=$c/@code] ) > 10
return $c/@name
```

3.5 Return, for every river in Great Britain, the length of that river.

```
for $gr in doc('xml/converted/a/geo_river_a.xml')//geo_river-tuple[@country='GB']
for $r in doc('xml/converted/a/river_a.xml')//river-tuple[@name=$gr/@river]
return  concat($r/@name, " ", $r/@length)
```

3.6 Return the name of the countries that have the 10 longest total length of rivers.

```
(for $c in doc('xml/converted/a/country_a.xml')//country-tuple
let $r := distinct-values( doc('xml/converted/a/geo_river_a.xml')//geo_river-
tuple[@country=$c/@code]/@river )
let $l := sum( data( doc('xml/converted/a/river_a.xml')//river-tuple[@name=$r and
@length != 'MISSING']/@length ) )
order by $l descending
return concat($c/@name, " ", $l)
)[position()<=10]
```

3.7 Return all the information available about cities whose name is Manchester.

```
doc('xml/converted/a/city_a.xml')//city-tuple[@name='Manchester']
```

3.8 Return the name of cities whose name starts with the substring 'Man'.

```
for $cn in doc('xml/converted/a/city_a.xml')//city-tuple/@name
where starts-with( $cn, 'Man')
return $cn
```

3.9 Return the name of the country and the name of the organization of countries with Buddhist populations that are members of organizations established after 1st December 1994.

```
for $r in doc('xml/converted/a/religion_a.xml')//religion-
tuple[@name='Buddhist']/@country
for $c in doc('xml/converted/a/country_a.xml')//country-tuple[@code=$r]
let $member := doc('xml/converted/a/ismember_a.xml')//ismember-
tuple[@country=$c/@code]/@organization
for $o in doc('xml/converted/a/organization_a.xml')//organization-
tuple[@abbreviation=$member and @established > '1994-12-01']
```

```
return concat($c/@name, " ---- ", $o/@name)
```

3.10 Return the name of each country with the number of islands in it.

```
for $c in doc('xml/converted/a/country_a.xml')//country-tuple
let $num := count( doc('xml/converted/a/geo_island_a.xml')//geo_island-
tuple[@country=$c/@code] )
return concat($c/@name, " ", $num)
```

4. Task 4

4.1 Return the names of countries that are not landlocked (i.e., have a sea coast).

```
distinct-values(
for $c in doc('xml/converted/e/country_e.xml')//country-tuple
for $geo in doc('xml/converted/e/geo_sea_e.xml')//geo_sea-tuple
where $c/code = $geo/country
return $c/name)
```

4.2 Return the names of all lakes, rivers and seas.

```
let $l := doc('xml/converted/e/lake_e.xml')//lake-tuple/name
let $r := doc('xml/converted/e/river_e.xml')//river-tuple/name
let $s := doc('xml/converted/e/sea_e.xml')//sea-tuple/name
return $l union $r union $s
```

4.3 Return the average length over all the rivers in the database.

```
let $l := data( doc('xml/converted/e/river_e.xml')//river-tuple[length !=
'MISSING']/length )
return avg($l)
```

4.4 Return the name of countries that have more than 10 islands.

```
for $c in doc('xml/converted/e/country_e.xml')//country-tuple
where count( doc('xml/converted/e/geo_island_e.xml')//geo_island-
tuple[country=$c/code] ) > 10
return $c/name
```

4.5 Return, for every river in Great Britain, the length of that river.

```
for $gr in doc('xml/converted/e/geo_river_e.xml')//geo_river-tuple[country='GB']
for $r in doc('xml/converted/e/river_e.xml')//river-tuple[name=$gr/river]
return  concat($r/name, " ", $r/length)
```

4.6 Return the name of the countries that have the 10 longest total length of rivers.

```
(for $c in doc('xml/converted/e/country_e.xml')//country-tuple
let $r := distinct-values( doc('xml/converted/e/geo_river_e.xml')//geo_river-
tuple[country=$c/code]/river )
let $l := sum( data( doc('xml/converted/e/river_e.xml')//river-tuple[name=$r and
length != 'MISSING']/length ) )
order by $l descending
return concat($c/name, " ", $l)
)[position()<=10]
```

4.7 Return all the information available about cities whose name is Manchester.

```
doc('xml/converted/e/city_e.xml')//city-tuple[name='Manchester']
```

4.8 Return the name of cities whose name starts with the substring 'Man'.

```
for $cn in doc('xml/converted/e/city_e.xml')//city-tuple/name
where starts-with( $cn, 'Man')
```

```
return $cn
```

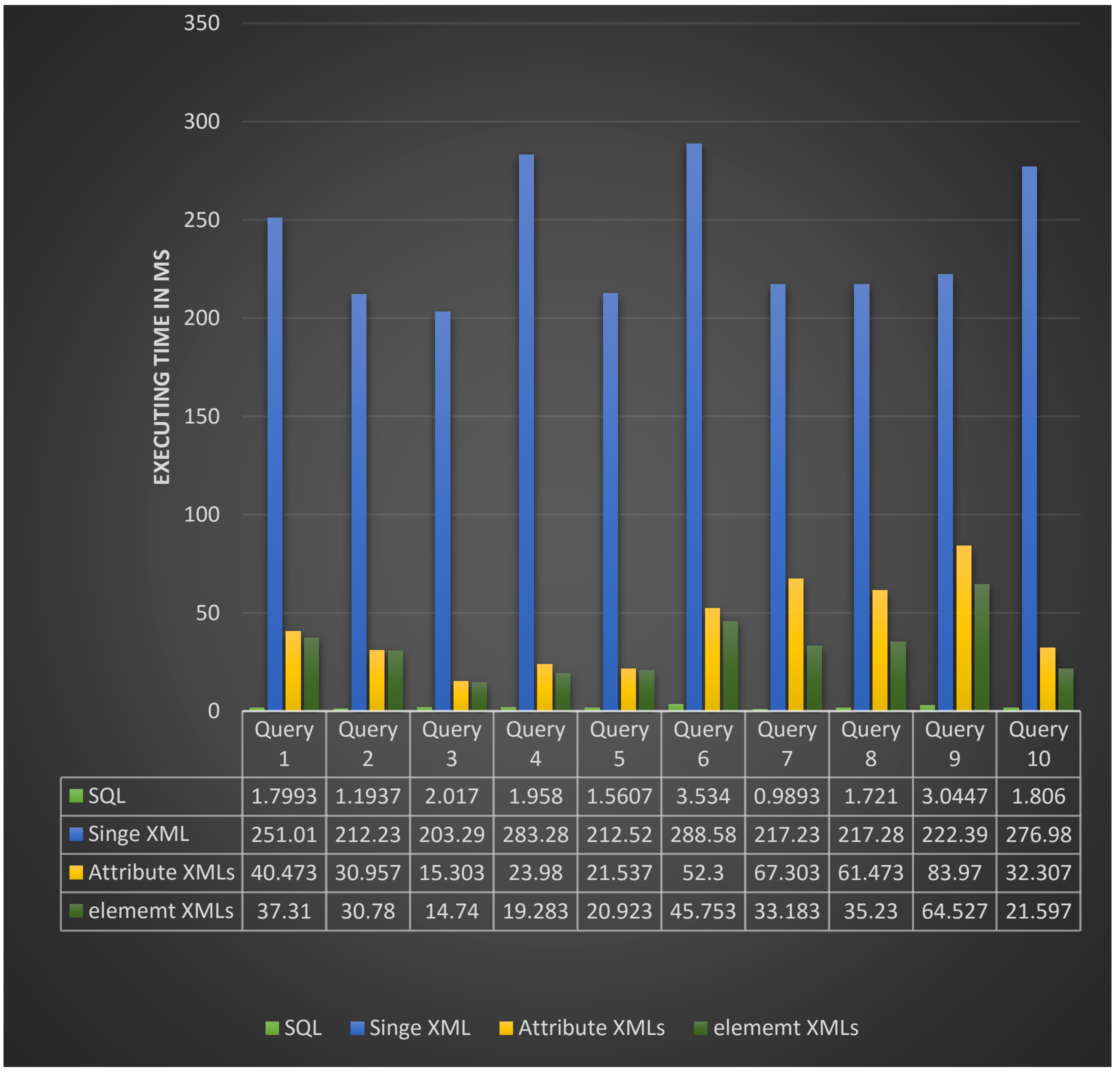
4.9 Return the name of the country and the name of the organization of countries with Buddhist populations that are members of organizations established after 1st December 1994.

```
for $r in doc('xml/converted/e/religion_e.xml')//religion-
tuple[name='Buddhist']/country
for $c in doc('xml/converted/e/country_e.xml')//country-tuple[code=$r]
let $member := doc('xml/converted/e/ismember_e.xml')//ismember-
tuple[country=$c/code]/organization
for $o in doc('xml/converted/e/organization_e.xml')//organization-
tuple[abbreviation=$member and established > '1994-12-01']
return concat($c/name, " ---- ", $o/name)
```

4.10 Return the name of each country with the number of islands in it.

```
for $c in doc('xml/converted/e/country_e.xml')//country-tuple
let $num := count( doc('xml/converted/e/geo_island_e.xml')//geo_island-
tuple[country=$c/code] )
return concat($c/name, " ", $num)
```

5 Task 5



	Query 1	Query 2	Query 3	Query 4	Query 5	Query 6	Query 7	Query 8	Query 9	Query 10
🟩 SQL	1.7993	1.1937	2.017	1.958	1.5607	3.534	0.9893	1.721	3.0447	1.806
🟦 Singe XML	251.01	212.23	203.29	283.28	212.52	288.58	217.23	217.28	222.39	276.98
🟨 Attribute XMLs	40.473	30.957	15.303	23.98	21.537	52.3	67.303	61.473	83.97	32.307
🟩 elememt XMLs	37.31	30.78	14.74	19.283	20.923	45.753	33.183	35.23	64.527	21.597

Figure 1. Statistic and comparison of average executing time of different queries on different kind of database

Table 1. Statistic of Query Result.

	SQL	Singe XML	Attribute XMLs	Element XMLs
Query 1	198	198	193	193
Query 2	413	432	382	382
Query 3	1	1	1	1
Query 4	12	9	11	11
Query 5	4	1	9	9
Query 6	10	10	10	10
Query 7	2	2	2	2
Query 8	18	20	16	16
Query 9	177	177	18	18
Query 10	293	244	238	238

In figure 1, it is clear that all SQLs cost the least time than other xqueries, around 1 to 2 milliseconds. While, the cost of Xqueries on a single xml file were significantly huge, all above 200ms. On xml model with attribute and element, the xqueries' executing time were very similar, ranged from 20 to 80 milliseconds.

From the observation above, we could see that SQL queries on sqlite3 performed best. The reason could be a) good performance of sqlite3 DBMS than other BaseX, such as using index in sqlie3 b) better optimizer of sqlite3 than others', c) for this experiment, data structured in table model was much suitable than in tree model. The file this relational data is 2.6MB.

Querying on a single file, which is a 3.5MB xml file, was the most costly. The results between this with SQL queries were barely different (less than 5% difference), as shown in table 1. The reason could be that a great amount of memory and time are needed on loading file and searching and filtering data from the whole file.

Comparing the cost between querying on attribute XMLS with element XMLs, they produced the same result from same data, yet, querying on attribute XMLs were slightly slower. The size of attribute and element XML files are 1.2MB and 5.2 MB respectively. They have different size of database file, but similar querying time. The reason could be that when querying, the numbers of accessed nodes are likely similar, thus cost similar time. However, it seems xml using elements could be better for query.

In conclusion, using relational DBMS is better than using XML database, the size of database file is moderate, and can be queried in a fast approach. Among three different XML model, using a single file is worst, resulting in large size of intermediate data and cost huge time on query. The XML model based on attribute requires the smallest size of file, but its performance on query needs improvement. Although the largest file is needed for modelling XML with elements, query on this performs much better than a single XML or with attribute. Thus, when modelling an xml database, it is better to model data with element or attribute.