Ex a)

```
db.target.aggregate([
  {
    $group: {
      _id: "$state_name",
      totalPopulation: { $sum: "$population" }
    }
  },
  {
    $match: {
      totalPopulation: { $gt: 10000000 }
    }
  }
])
```

```
test> db.target.aggregate([
...    {
...       $group: {
...         _id: "$state_name",
...         totalPopulation: { $sum: "$population" }
...       }
...    },
...    {
...       $match: {
...         totalPopulation: { $gt: 10000000 }
...       }
...    }
... ])
[
  { _id: 'California', totalPopulation: 39323978 },
  { _id: 'Illinois', totalPopulation: 12714937 },
  { _id: 'Pennsylvania', totalPopulation: 12790016 },
  { _id: 'Texas', totalPopulation: 28628347 },
  { _id: 'New York', totalPopulation: 19513330 },
  { _id: 'North Carolina', totalPopulation: 10377391 },
  { _id: 'Ohio', totalPopulation: 11669378 },
  { _id: 'Georgia', totalPopulation: 10511012 },
  { _id: 'Florida', totalPopulation: 21153257 }
]
test>
```

Ex b)

```
db.target.aggregate([
  {
    $group: {
      _id: {
        state: "$state_name",
        city: "$city"
      },
      population: { $sum: "$population" }
    }
  },
  {
    $group: {
      _id: "$_id.state",
      averagePopulation: { $avg: "$population" }
    }
  }
])
```

```
test> db.target.aggregate([
...     {
...       $group: {
...         _id: {
...           state: "$state_name",
...           city: "$city"
...         },
...         population: { $sum: "$population" }
...       }
...     },
...     {
...       $group: {
...         _id: "$_id.state",
...         averagePopulation: { $avg: "$population" }
...       }
...     }
... ])
[
  { _id: 'Utah', averagePopulation: 12525.733067729083 },
  { _id: 'Nevada', averagePopulation: 31567.21875 },
  { _id: 'Oklahoma', averagePopulation: 6927.956140350877 },
  { _id: 'Hawaii', averagePopulation: 17066.90361445783 },
  { _id: 'Colorado', averagePopulation: 14606.668380462725 },
  { _id: 'California', averagePopulation: 32989.9144295302 },
  { _id: 'American Samoa', averagePopulation: 0 },
  { _id: 'West Virginia', averagePopulation: 2528.7377279102384 },
  { _id: 'Tennessee', averagePopulation: 13007.632692307692 },
  { _id: 'Missouri', averagePopulation: 6811.87319243604 },
  { _id: 'Vermont', averagePopulation: 2400.9307692307693 },
  { _id: 'Alaska', averagePopulation: 3273.95067264574 },
  { _id: 'Rhode Island', averagePopulation: 15788.029850746268 },
  { _id: 'Washington', averagePopulation: 16191.546436285098 },
  { _id: 'Virginia', averagePopulation: 11742.841160220994 },
  { _id: 'South Dakota', averagePopulation: 2420.2038567493114 },
  { _id: 'Wyoming', averagePopulation: 3380.703488372093 },
```

```
... ])
[
  { _id: 'Utah', averagePopulation: 12525.733067729083 },
  { _id: 'Nevada', averagePopulation: 31567.21875 },
  { _id: 'Oklahoma', averagePopulation: 6927.956140350877 },
  { _id: 'Hawaii', averagePopulation: 17066.90361445783 },
  { _id: 'Colorado', averagePopulation: 14606.668380462725 },
  { _id: 'California', averagePopulation: 32989.9144295302 },
  { _id: 'American Samoa', averagePopulation: 0 },
  { _id: 'West Virginia', averagePopulation: 2528.7377279102384 },
  { _id: 'Tennessee', averagePopulation: 13007.632692307692 },
  { _id: 'Missouri', averagePopulation: 6811.87319243604 },
  { _id: 'Vermont', averagePopulation: 2400.9307692307693 },
  { _id: 'Alaska', averagePopulation: 3273.95067264574 },
  { _id: 'Rhode Island', averagePopulation: 15788.029850746268 },
  { _id: 'Washington', averagePopulation: 16191.546436285098 },
  { _id: 'Virginia', averagePopulation: 11742.841160220994 },
  { _id: 'South Dakota', averagePopulation: 2420.2038567493114 },
  { _id: 'Wyoming', averagePopulation: 3380.703488372093 },
  { _id: 'New Mexico', averagePopulation: 6249.754491017964 },
  { _id: 'Idaho', averagePopulation: 6863.403921568627 },
  { _id: 'Nebraska', averagePopulation: 3657.4980988593156 }
]
Type "it" for more
test> it
[
  { _id: 'Arkansas', averagePopulation: 5219.123050259966 },
  { _id: 'Montana', averagePopulation: 3000.6977401129943 },
  { _id: 'Maryland', averagePopulation: 15168.547738693467 },
  { _id: 'Connecticut', averagePopulation: 14754.314049586777 },
  { _id: 'Illinois', averagePopulation: 10115.303898170247 },
  { _id: 'Kentucky', averagePopulation: 6192.072122052705 },
  { _id: 'Massachusetts', averagePopulation: 14841.492440604752 },
  { _id: 'Delaware', averagePopulation: 17887.61111111111 },
```

Ex c)

```
db.target.aggregate([
  {
    $group: {
      _id: {
        state: "$state_name",
        city: "$city"
      },
      population: { $sum: "$population" }
    }
  },
  {
    $sort: {
      "population": -1
    }
  },
  {
    $group: {
      _id: "$_id.state",
      largestCity: { $first: "$_id.city" },
      largestPopulation: { $first: "$population" },
      smallestCity: { $last: "$_id.city" },
      smallestPopulation: { $last: "$population" }
    }
  }
])
```

```
...    {
...      $group: {
...        _id: {
...          state: "$state_name",
...          city: "$city"
...        },
...        population: { $sum: "$population" }
...      }
...    },
...    {
...      $sort: {
...        "population": -1
...      }
...    },
...    {
...      $group: {
...        _id: "$_id.state",
...        largestCity: { $first: "$_id.city" },
...        largestPopulation: { $first: "$population" },
...        smallestCity: { $last: "$_id.city" },
...        smallestPopulation: { $last: "$population" }
...      }
...    }
...  ])
[
  {
    _id: 'Missouri',
    largestCity: 'Saint Louis',
    largestPopulation: 909666,
    smallestCity: 'New Melle',
    smallestPopulation: 0
  },
  {
    _id: 'New Mexico',
    largestCity: 'Albuquerque',
```

Ex d)

db.target.aggregate([

  {

    $group: {

      _id: {

        state: "$state_name",

        county: "$county_name"

      },

      population: { $sum: "$population" }

    }

  },

  {

    $sort: {
```

```
      "population": -1

    }

  },

  {

    $group: {

      _id: "$_id.state",

      largestCounty: { $first: "$_id.county" },

      largestPopulation: { $first: "$population" },

      smallestCounty: { $last: "$_id.county" },

      smallestPopulation: { $last: "$population" }

    }

  }

])
```

```
Type "it" for more
...     {
...       $group: {
...         _id: {
...           state: "$state_name",
...           county: "$county_name"
...         },
...         population: { $sum: "$population" }
...       }
...     },
...     {
...       $sort: {
...         "population": -1
...       }
...     },
...     {
...       $group: {
...         _id: "$_id.state",
...         largestCounty: { $first: "$_id.county" },
...         largestPopulation: { $first: "$population" },
...         smallestCounty: { $last: "$_id.county" },
...         smallestPopulation: { $last: "$population" }
...       }
...     }
... ])
[
  {
    _id: 'Virgin Islands',
    largestCounty: 'St. John',
    largestPopulation: 0,
    smallestCounty: 'St. Croix',
    smallestPopulation: 0
  },
  {
```

Ex e)

```
db.target.find().forEach(function(doc) {
  var lat = parseFloat(doc.lat);
  var lng = parseFloat(doc.lng);
  db.target.updateOne(
    { _id: doc._id },
    { $set: { location: { type: "Point", coordinates: [lng, lat] } } }
  );
});


db.target.createIndex({ location: "2dsphere" });


db.target.aggregate([
  {
    $geoNear: {
      near: {
        type: "Point",
        coordinates: [-87.635918, 41.878876]
      },
      distanceField: "distance",
      spherical: true,
      query: {}
    }
  },
  {  $limit: 10  }
])
```

```
test>

...   {
...     $geoNear: {
...       near: {
...         type: "Point",
...         coordinates: [-87.635918, 41.878876]
...       },
...       distanceField: "distance",
...       spherical: true,
...       query: {}
...     }
...   },
...   {   $limit: 10   }
... ])
[
  {
    _id: ObjectId('6658a8fcc154627a692174a5'),
    zip: 60606,
    lat: 41.88178,
    lng: -87.63724,
    city: 'Chicago',
    state_id: 'IL',
    state_name: 'Illinois',
    zcta: 'TRUE',
    population: 3204,
    density: 5330.7,
test>
    county_name: 'Cook',
    county_weights: { '17031': 100 },
    county_names_all: 'Cook',
    county_fips_all: 17031,
    imprecise: 'FALSE',
    military: 'FALSE',
    timezone: 'America/Chicago',
    location2dsphere: { type: 'Point', coordinates: [ -87.63724, 41.88178 ] },
    location: { type: 'Point', coordinates: [ -87.63724, 41.88178 ] },
    distance: 341.33394676341226
  },
  {
    id: ObjectId('6658a8fcc154627a692174a3'),
```

Ex f) db.target.aggregate([

 {

  $geoNear: {

   near: {

    type: "Point",

    coordinates: [-74.044502, 40.689247]

   },

   distanceField: "distance",

   spherical: true,

   query: {}

```
    }
  },
  {
    $match: {
      distance: {
        $gte: 50000,   // 50 kilometers
        $lte: 200000   // 200 kilometers
      }
    }
  },
  {
    $group: {
      _id: 0,
      totalPopulation: { $sum: "$population" }
    }
  }
])
```

```
test> db.target.aggregate([
...     {
...       $geoNear: {
...         near: {
...           type: "Point",
...           coordinates: [-74.044502, 40.689247]
...         },
...         distanceField: "distance",
...         spherical: true,
...         query: {}
...       }
...     },
...     {
...       $match: {
...         distance: {
...           $gte: 50000,    // 50 kilometers
...           $lte: 200000   // 200 kilometers
...         }
...       }
...     },
...     {
...       $group: {
...         _id: 0,
...         totalPopulation: { $sum: "$population" }
...       }
...     }
... ])
[ { _id: 0, totalPopulation: 17679688 } ]
test>
```