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**INTERNATIONAL HEALTH AND POPULATION MATRICS APPLICATION**

## **International health and population metrics**

**International health and population metric**

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**Introduction**

United States Census Bureau created the international database to provide timely information regarding the demographic measures of population around the world[1]. This database consists of various indicators and it has been updated regularly to provide useful information for program planning, research and policy-making globally. International Database provides information of 228 countries where the population is more than 5000[1]. It provides comprehensive statistics about population size by age and sex, and factors of population change such as fertility, migration and mortality from 1950 to 2050[2].

Demographic analysis is a technique used to develop an understanding of the age, sex, and racial composition of a population and how it has changed over time through the basic demographic processes of birth, death, and migration. Demographic Analysis (usually abbreviated as DA) also refers to a specific set of techniques for developing national population estimates by age, sex, and race from administrative records to be used to assess the quality of the decennial census. Our datasets have data about population, age, mortality rate, year, country, fertility rate and birth death ratio. Which can be analysed to discover knowledge and demographics.

# **Motivation**

The world population has experienced continuous growth and it is estimated to have reached 7.7 billion people as of December 2019. There are various factors involved in population development and it can be analysed using attributes such as age, sex, population by age, fertility rate, mortality rate, infant mortality, net migration. Diversity in population can affect fundamental challenges that world is facing or might face such as assurance of food, provision of social protection, health, education and other goods and services. Some other challenges such as environmental factors , global warming , climate change and adaptation must be addressed to ensure sustainable development of humanity. It is possible to predict accurate requirement of goods and services which can lead to higher living standards and steady technological and economic development. Demographics can be used by companies to drill down ideal customers and discovering profitable opportunities for marketing their products. For example a health services company can target old age audience as they might need more medical attention than younger population. It can be concluded that demographics can be used to predict current and future requirement of civilizations including various social, economic and business needs.

**Intended Functionalities**

We have attempted to bring out maximum relevant information from the data available to us and summarized them into a set of functionalities that the database application soughts to provide. These functionalities are expressed in terms of the specific information that will be accessible/visible to a regular user:

* **Rate of population growth** is the natural increase combined with the effects that migration have on a country[3]. User can find the population growth rate specific to their country of choice. Also user can have a specific view of how the population growth rate has been affected along the years and gender.
* It refers to a population that is unchanging – it is neither growing, nor declining; the growth rate is zero. It also accounts for the country's immigration (when a person migrates to a country) and emigration (when a person leaves their country to settle somewhere new). Therefore end user can find the **zero population growth** of a country as it is a critical component to long-term sustainability for a country, region, or the world.
* From crude birth rate and crude death rate user can calculate the natural increase which is the difference between the numbers of births and deaths in a population (CBR-CDR)%.
* User can estimate the sex ratio of different countries over a period of time.
* User can find the **doubling time** of a selected country which is the time it requires for a country to double its population. It takes into consideration the annual growth rate. Doubling time = 70/annual growth rate
* User can trace demographic shifts, calculate a country’s crude birth rate which is the annual live births per 1,000 population.
* User can trace demographic shifts[4], calculate a country’s crude death rate which is the annual deaths per 1,000 population.
* User can be informed about the ratio between elderly : young people of a chosen country.
* The user can get information about countries in increasing/decreasing order of their population where infant mortality rate of females is greater as compared to infant mortality rate of males.
* User can compare the average fertility of the selected country with the world's average fertility.
* The aim is to find **population density** which can be found by analysing population of the country in a year and dividing it by the total area of the country. Population density will indicate how many people are living per unit area in the country
* Average population density by world: We can find the average population density, when we have population density of each country and divide it with the number of countries.
* Also, the user will be able to list the top 10 countries having the highest population density and lowest population density .
* **Growth or decline in Mortality by country:** This is the probability of children dying in the country[5]. It will enable the user to determine the change in mortality over time in years for different countries. It will help to determine which country needs more attention if the mortality rate is increasing and help establish what factors let to decline of mortality rate.
* Average mortality of the world : we can find average mortality of the world using mortality rate of each country and dividing it by the total number of countries in the world.
* **Age dependency ratio:** Itis defined as the number of dependents aged zero to 14 and over the age of 65, compared with the total population that lies between the age of 15 to 64. The user will be able to view the number of people in the non-working age, compared with the number of people falling in the category of working age for different countries and genders. The higher the age dependency ratio of a country, there is a need for better healthcare and medical resources.
* User can find countries highest/lowest age dependency ratio for top 10 countries
* User can find average age dependency ratio for the world
* **Life Expectancy**: The user can get information whether the life expectancy of the world has increased or decreased over the years. Along with this information, the user can also get information whether life expectancy of female and male have increased or decreased over the average life expectancy of the world.
* User can get information regarding the top 10 countries whose life expectancy has increased/decreased for a given period of years.
* User can get information regarding the top 10 countries where life expectancy of females is more than the life expectancy of males.
* User can get information regarding the top 10 countries where life expectancy of males is more than the life expectancy of females.
* **Mobility**: User can get information regarding the percentage of people migrating from one country to another country when compared to total population has increased or decreased over a period of years.
* User can get information regarding top 10 countries where migration is more for a given period of years.
* User can get information regarding top 10 countries where migration is less for a given period of years.
* **Child Bearing Years:** Itis defined as the female aged between 12 to 51[6]. The user will be able to view the ratio of female who are in child bearing age to women who are not in child bearing age.
* Number of children under age 5 per 1000 women in the age group between 15 and 49 for a given year. This gives a crude fertility measure. The user will be able to list the countries in increasing/decreasing order of **child-woman ratio** over a period of time.
* User will be able to find the top 5 countries where child-woman ratio is lesser than the average child-woman ratio.
* User will be able to find the top 5 countries with higher male-child woman ratio over female-child woman ratio over a period of time.

**Tentative Queries**

Based on the data available, we have come up with tentative queries that could bring out relevant information that the users would like to see:

● Determine the population growth rate of females in <country> from <year 1> to <year2> also considering migration rate.

Eg: Determine the population growth rate of females in Ukraine from 2010 to 2020 also considering migration rate.

* List all the countries whose projected growth rate is zero till 2050.
* Determine the time span of <country> to double its population (doubling time) considering the factors like crude birth rate, crude death rate and migration rate from 1950.

Eg: Determine the time span of Ethiopia to double its population (doubling time) considering the factors like crude birth rate, crude death rate and migration rate from 1950

* List all the countries which will have more than 60% elderly people by 2050.
* List all the countries in increasing order of their population where infant mortality rate of females is greater as compared to infant mortality rate of males.
* Comparing the population density of a <country> at different time period.
* Compare the productive age ratio (ratio of the number of people in the working-age group to number of people in the non-working age group) of the country with the highest population density to the productive age ratio of the country having the lowest population density.
* Give the graphical representation of life expectancy of the world from 1950 to 2050?
* What is the overall life expectancy of male when compared to life expectancy of female between 1950 to 2050?
* What is the trend in mortality rate of the world from 1950 to 2050?
* Which countries mortality rate is going to increase from 2020 to 2050?
* Which countries mortality rate has improved over the years from 1950 to 2020?
* List the top 10 countries where the age-dependency ratio is highest by 2020.
* What is the trend in mobility of the world from 1950 to 2050?
* List top 10 countries where the migration of people was maximum from 2015 to 2020.
* Arrange the countries in order of predicted value of migration of people from 2020 to 2030.
* Is infant mortality rate of female of the <country> in 2000 has affected the ratio of female in child bearing in 2020 to 2030?
* Arrange the countries in order where the infant mortality rate of girl is more than the infant mortality rate of male.
* What is the trend of male population over female population from 1950 to 2050?
* Compare how the countries with highest and lowest age dependency ratio changed from 1950-2050 in every 10 years.
* List the top 20 countries in decreasing order of their age-dependency ratio.
* List the countries where increase in migration rate has made a higher contributions in increasing population density over natural increase rate (i.e. Birth rate - death rate) over a period of years.
* Name the top 5 countries with higher male-child woman ratio over female-child woman ratio over a period of time. Compare their overall child-woman ratio from <year1> to <year 2>.

Example: Name the top 5 countries with higher male-child woman ratio over female-child woman ratio over a period of time. Compare their overall child-woman ratio from 1990 to 2010.

* For the top 15 countries having the highest child-bearing ratio, arrange the population density of children aged 0-5 years in decreasing order over a period of time.

# **Data and Software Specifications**

## **Data**

Our database will consist of International Data categorized into five major elements that we identified as main entities, namely: Birth Rate, Growth Rate, Infant Mortality Rate, Midyear Population and Population Density. The dataset provides the information from 1950 and projections through 2050 and examine various factors associated with population change[2]. All the functionalities of the web application will revolve around extracting useful information from the available data sets and visualizing them to generate insights to make it more interactive and exact[7][8]. In our database, user shall be able to access visualized country specific details such as which country has most infant mortality rate by year, their population change during specific years, their growth trends, migration rate for each country and how it has affected the growth of the country. The interface is intended to be highly user friendly while not compromising on the level of details that the users expect to see when they utilize the various features of our application. The idea is to provide ease of access to information about the world population, various factors affecting the population in various countries[9]. In the dataset we have **8 tables** and **more than one million records.**

*Data sources: Our prime data sources have been Kaggle and data.world. (Links to the sources have been included under ‘References’ section of the documentation).*

**Software Requirements**

● CISE Oracle Database Server, SQLdeveloper for Storing and Querying the acquired data (Backend).

● HTML, CSS , Bootstrap, Jquery for web designing the web application interface (Frontend).

**References**

[1]<https://www.census.gov/programs-surveys/international-programs/about/idb.html>

[2]<https://www.kaggle.com/census/international-data>

[3]<https://www.quia.com/jg/2791555list.html>

[4]<https://extension.unh.edu/resources/files/Resource004765_Rep6784.pdf>

[5]<https://www.prb.org/glossary/>

[6]<https://en.wikipedia.org/wiki/World_population>

[7]<https://www.census.gov/>

[8]<https://data.census.gov/cedsci/profile?q=United%20States&g=0100000US&table=DP05&tid=ACSDP1Y2018.DP05>

[9]<https://www.census.gov/data-tools/demo/idb/informationGateway.php>

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