**Course Project Part I**

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MATH399 Applied Managerial Statistics

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**Introduction**

The topic under analysis is the personal income in different states in 2018. The focus of the analysis is to determine the states where personal incomes are reducing and where it is increasing to establish its effect on the economy. The incomes earned by residents in the 50 states and the District of Columbia come from dividends, government benefits, wages, rents, proprietors’ incomes, and interest. The data is obtained from the Bureau of Economic Analysis, which is a website by the United States government.

<https://www.bea.gov/news/2020/real-personal-income-state-and-metropolitan-area-2018>

**Sample Data—**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Personal income  [Millions of dollars] | | |
| 2017 | 2018 | Percent change |
| **United States1** | **16,870,106** | **17,813,035** | **5.6** |
| Alabama | 197,283 | 206,455 | 4.6 |
| Alaska | 42,015 | 43,818 | 4.3 |
| Arizona | 299,613 | 317,913 | 6.1 |
| Arkansas | 124,684 | 130,297 | 4.5 |
| California | 2,370,112 | 2,514,129 | 6.1 |
| Colorado | 310,755 | 332,943 | 7.1 |
| Connecticut | 258,079 | 273,152 | 5.8 |
| Delaware | 48,189 | 50,783 | 5.4 |
| District of Columbia | 54,938 | 57,605 | 4.9 |
| Florida | 1,004,144 | 1,066,447 | 6.2 |
| Georgia | 463,756 | 488,964 | 5.4 |
| Hawaii | 75,689 | 78,721 | 4.0 |
| Idaho | 72,355 | 77,012 | 6.4 |
| Illinois | 689,724 | 724,189 | 5.0 |
| Indiana | 301,203 | 315,516 | 4.8 |
| Iowa | 149,191 | 158,197 | 6.0 |
| Kansas | 142,242 | 149,859 | 5.4 |
| Kentucky | 182,605 | 189,717 | 3.9 |
| Louisiana | 205,227 | 215,489 | 5.0 |
| Maine | 62,173 | 65,454 | 5.3 |
| Maryland | 364,576 | 382,829 | 5.0 |
| Massachusetts | 468,300 | 494,765 | 5.7 |
| Michigan | 461,486 | 484,030 | 4.9 |
| Minnesota | 305,795 | 322,728 | 5.5 |
| Mississippi | 108,749 | 112,992 | 3.9 |
| Missouri | 279,433 | 292,513 | 4.7 |
| Montana | 47,718 | 50,500 | 5.8 |
| Nebraska | 97,151 | 102,759 | 5.8 |
| Nevada | 139,449 | 149,219 | 7.0 |
| New Hampshire | 78,822 | 83,143 | 5.5 |
| New Jersey | 577,081 | 607,884 | 5.3 |
| New Mexico | 82,733 | 87,189 | 5.4 |
| New York | 1,286,023 | 1,341,932 | 4.3 |
| North Carolina | 453,769 | 478,862 | 5.5 |
| North Dakota | 39,775 | 42,148 | 6.0 |
| Ohio | 544,141 | 569,727 | 4.7 |
| Oklahoma | 171,597 | 182,302 | 6.2 |
| Oregon | 200,579 | 213,070 | 6.2 |
| Pennsylvania | 679,731 | 720,073 | 5.9 |
| Rhode Island | 55,337 | 57,994 | 4.8 |
| South Carolina | 211,299 | 222,189 | 5.2 |
| South Dakota | 43,275 | 46,066 | 6.5 |
| Tennessee | 301,560 | 317,515 | 5.3 |
| Texas | 1,357,466 | 1,445,270 | 6.5 |
| Utah | 136,544 | 146,423 | 7.2 |
| Vermont | 32,461 | 33,929 | 4.5 |
| Virginia | 468,177 | 492,313 | 5.2 |
| Washington | 434,759 | 467,399 | 7.5 |
| West Virginia | 70,218 | 73,809 | 5.1 |
| Wisconsin | 285,487 | 299,933 | 5.1 |
| Wyoming | 32,639 | 34,873 | 6.8 |

1. **Problem Computations:**

* **Determine the mean and standard deviation of your sample.**

The mean of the personal income in all 50states is 344567.2 (millions of dollars)

The standard deviation of the incomes is 432699.8 (millions of dollars)

* **Find the 80%, 95%, and 99% confidence intervals.**

The 80% confidence interval is;



The margin of error for the state’s personal income is 77,649.32, which means that the expected results from the sample will differ from the actual income value by 77,649.32.

The 95% confidence interval is below;

|  |  |  |  |
| --- | --- | --- | --- |
| 2,25,812.807 | confidence interval 95. % lower | | |
| 4,63,321.585 | confidence interval 95. % upper | | |
| 1,18,754.389 | margin of error | |  |
| 60,590.087 | std. error |  |  |

The margin of error for personal income is 60,590.09, which means that the expected results from the sample will differ from the actual income value by 60,590.09.

For the 99% confidence interval;

|  |  |  |  |
| --- | --- | --- | --- |
| 1,88,497.474 | confidence interval 99. % lower | | |
| 5,00,636.918 | confidence interval 99. % upper | | |
| 1,56,069.722 | margin of error | |  |
| 60,590.087 | std. error |  |  |

The margin of error is 1,56,069.72, which is the most amount by which the results of the sample will vary from the actual value by 1,56,069.72.

* **My confidence interval**

My confidence interval is at the 90% level as calculated below;

|  |  |  |  |
| --- | --- | --- | --- |
| 2,44,905.371 | confidence interval 90.% lower | | |
| 4,44,229.021 | confidence interval 90.% upper | | |
| 99,661.825 | margin of error | |  |
| 60,590.087 | std. error |  |  |

The margin of error is 60,590.09, which is the most amount that would vary from the actual value of 60,590.08.

**Problem Analysis**

As the confidence interval increases, the lower limit is declining. This suggests an inverse relationship between the lower limit and the confidence level. As the confidence level rises, the upper limit also goes up. This suggests that there is a direct link between the upper limit and the confidence interval.

In this case, the 80% confidence interval is located between 2,66,917.88 and 4,22,216.52. This also means that there is an 80% chance that the actual personal income mean is between the two values above. The confidence interval is located between 2,25,812.80 and 4,63,321.59, which also means that this would be the true mean personal income has a 95% chance to be between the two values. The confidence interval is between 2,44,905.371 and 4,44,229.021 that suggests the true personal income has a 90% chance that it would be between the two values. The 99% confidence interval is between 5,00,636.92 and 1,88,497.47, and this means that there is a 99% chance that the personal income is also between the two variables.

Part I of the project has helped me understand the accuracy of the estimate provided and that the values based on the intervals seem unexpected. The confidence interval is also clearer and easier to interpret when compared to standard errors, which give a range of values that are almost accurate. The project has allowed me to understand how to use the confidence interval to get the average personal income in 50 states. The data can help make plans to develop the economy.