Alabama, United States ADMINISTRATIVE DIVISION [

population Interval[{ Year: **1900** , Day: **Thu 1 Nov 2018** }]]

In[7]:=
```
Data = {{{1900, 1, 1, 0, 0, 0.`}, 1 828 697},
  {{1910, 1, 1, 0, 0, 0.`}, 2 138 093}, {{1920, 1, 1, 0, 0, 0.`}, 2 348 174},
  {{1930, 1, 1, 0, 0, 0.`}, 2 646 248}, {{1940, 1, 1, 0, 0, 0.`}, 2 832 961},
  {{1950, 1, 1, 0, 0, 0.`}, 3 061 743}, {{1960, 1, 1, 0, 0, 0.`}, 3 266 740},
  {{1970, 1, 1, 0, 0, 0.`}, 3 444 354}, {{1980, 1, 1, 0, 0, 0.`}, 3 894 025},
  {{1990, 1, 1, 0, 0, 0.`}, 4 040 587}, {{2000, 1, 1, 0, 0, 0.`}, 4 451 849},
  {{2001, 1, 1, 0, 0, 0.`}, 4 464 034}, {{2002, 1, 1, 0, 0, 0.`}, 4 472 420},
  {{2003, 1, 1, 0, 0, 0.`}, 4 490 591}, {{2004, 1, 1, 0, 0, 0.`}, 4 512 190},
  {{2005, 1, 1, 0, 0, 0.`}, 4 545 049}, {{2006, 1, 1, 0, 0, 0.`}, 4 597 688},
  {{2007, 1, 1, 0, 0, 0.`}, 4 637 904}, {{2008, 1, 1, 0, 0, 0.`}, 4 677 464},
  {{2009, 1, 1, 0, 0, 0.`}, 4 708 708}, {{2010, 1, 1, 0, 0, 0.`}, 4 779 736},
  {{2011, 1, 1, 0, 0, 0.`}, 4 801 695}, {{2012, 1, 1, 0, 0, 0.`}, 4 817 484},
  {{2013, 1, 1, 0, 0, 0.`}, 4 833 996}, {{2014, 1, 1, 0, 0, 0.`}, 4 849 377}}
```

Out[7]=
```
{{{1900, 1, 1, 0, 0, 0.}, 1 828 697},
 {{1910, 1, 1, 0, 0, 0.}, 2 138 093}, {{1920, 1, 1, 0, 0, 0.}, 2 348 174},
 {{1930, 1, 1, 0, 0, 0.}, 2 646 248}, {{1940, 1, 1, 0, 0, 0.}, 2 832 961},
 {{1950, 1, 1, 0, 0, 0.}, 3 061 743}, {{1960, 1, 1, 0, 0, 0.}, 3 266 740},
 {{1970, 1, 1, 0, 0, 0.}, 3 444 354}, {{1980, 1, 1, 0, 0, 0.}, 3 894 025},
 {{1990, 1, 1, 0, 0, 0.}, 4 040 587}, {{2000, 1, 1, 0, 0, 0.}, 4 451 849},
 {{2001, 1, 1, 0, 0, 0.}, 4 464 034}, {{2002, 1, 1, 0, 0, 0.}, 4 472 420},
 {{2003, 1, 1, 0, 0, 0.}, 4 490 591}, {{2004, 1, 1, 0, 0, 0.}, 4 512 190},
 {{2005, 1, 1, 0, 0, 0.}, 4 545 049}, {{2006, 1, 1, 0, 0, 0.}, 4 597 688},
 {{2007, 1, 1, 0, 0, 0.}, 4 637 904}, {{2008, 1, 1, 0, 0, 0.}, 4 677 464},
 {{2009, 1, 1, 0, 0, 0.}, 4 708 708}, {{2010, 1, 1, 0, 0, 0.}, 4 779 736},
 {{2011, 1, 1, 0, 0, 0.}, 4 801 695}, {{2012, 1, 1, 0, 0, 0.}, 4 817 484},
 {{2013, 1, 1, 0, 0, 0.}, 4 833 996}, {{2014, 1, 1, 0, 0, 0.}, 4 849 377}}
```

In[20]:=
```
Year = Table[Data[[x]][[1]][[1]], {x, 1, 25}]
```

Out[20]=
```
{1900, 1910, 1920, 1930, 1940, 1950, 1960, 1970, 1980, 1990, 2000, 2001,
 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014}
```

In[21]:=
```
Population = Table[Data[[x]][[2]], {x, 1, 25}]
```

Out[21]=
```
{1 828 697, 2 138 093, 2 348 174, 2 646 248, 2 832 961, 3 061 743,
 3 266 740, 3 444 354, 3 894 025, 4 040 587, 4 451 849, 4 464 034,
 4 472 420, 4 490 591, 4 512 190, 4 545 049, 4 597 688, 4 637 904,
 4 677 464, 4 708 708, 4 779 736, 4 801 695, 4 817 484, 4 833 996, 4 849 377}
```

In[22]:=
```
DataRefined = Transpose[{Year, Population}]
```

Out[22]=
```
{{1900, 1 828 697}, {1910, 2 138 093}, {1920, 2 348 174},
 {1930, 2 646 248}, {1940, 2 832 961}, {1950, 3 061 743},
 {1960, 3 266 740}, {1970, 3 444 354}, {1980, 3 894 025},
 {1990, 4 040 587}, {2000, 4 451 849}, {2001, 4 464 034}, {2002, 4 472 420},
 {2003, 4 490 591}, {2004, 4 512 190}, {2005, 4 545 049}, {2006, 4 597 688},
 {2007, 4 637 904}, {2008, 4 677 464}, {2009, 4 708 708}, {2010, 4 779 736},
 {2011, 4 801 695}, {2012, 4 817 484}, {2013, 4 833 996}, {2014, 4 849 377}}
```

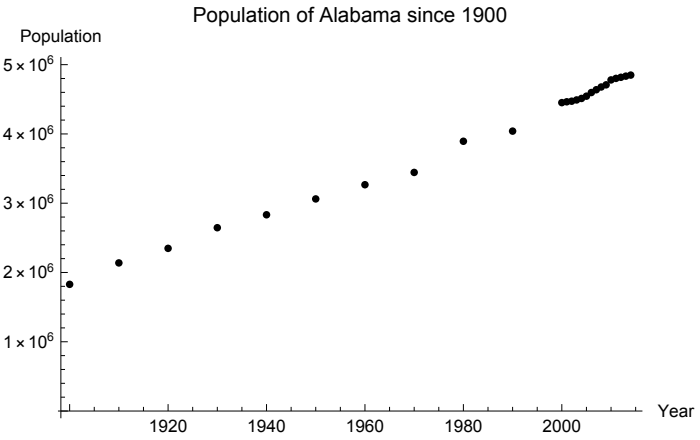
In[23]:=
```
Text[Grid[Prepend[DataRefined, {"Year", "Population"}],
  Alignment → Center, Dividers → {2 → true, 2 → true}]]
```

Out[23]=

Year	Population
1900	1 828 697
1910	2 138 093
1920	2 348 174
1930	2 646 248
1940	2 832 961
1950	3 061 743
1960	3 266 740
1970	3 444 354
1980	3 894 025
1990	4 040 587
2000	4 451 849
2001	4 464 034
2002	4 472 420
2003	4 490 591
2004	4 512 190
2005	4 545 049
2006	4 597 688
2007	4 637 904
2008	4 677 464
2009	4 708 708
2010	4 779 736
2011	4 801 695
2012	4 817 484
2013	4 833 996
2014	4 849 377

In[68]:=
```
DataPlot = ListPlot[DataRefined, AxesLabel → {"Year", "Population"},
  PlotStyle → Black, PlotLabel → "Population of Alabama since 1900"]
```

Out[68]=



In[27]:=
```
Median1 = {(DataRefined[[4, 1]] + DataRefined[[5, 1]]) / 2,
  (DataRefined[[4, 2]] + DataRefined[[5, 2]]) / 2}
```

Out[27]= $\left\{1935, \frac{5\,479\,209}{2}\right\}$

In[28]:=
```
Median2 = DataRefined[[13]]
```

Out[28]= {2002, 4 472 420}

In[29]:=
```
Median3 = {(DataRefined[[21, 1]] + DataRefined[[22, 1]]) / 2,
  (DataRefined[[21, 2]] + DataRefined[[22, 2]]) / 2}
```

Out[29]= $\left\{\frac{4021}{2}, \frac{9\,581\,431}{2}\right\}$

In[30]:=
```
Slope = (Median3[[2]] - Median1[[2]]) / (Median3[[1]] - Median1[[1]])
```

Out[30]= $\frac{4\,102\,222}{151}$

In[42]:=
```
yIntercept1 = Median3[[2]] - Median3[[1]] * Slope
```

Out[42]= $-\frac{15\,048\,238\,581}{302}$

In[44]:=
```
yIntercept2 = Median2[[2]] - Median2[[1]] * Slope
```

Out[44]= $-\frac{7\,537\,313\,024}{151}$

In[43]:=
```
distance = yIntercept1 - yIntercept2
```

Out[43]= $\frac{26\,387\,467}{302}$

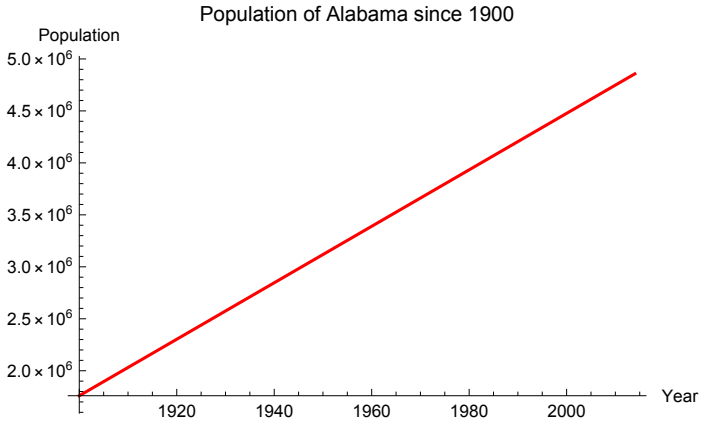
In[46]:=
```
yIntercept3 = yIntercept2 + (2 / 3) * distance
```

Out[46]=
$$-\frac{22\,585\,551\,605}{453}$$

In[47]:=
```
f[x_] := Slope * x + yIntercept3
```

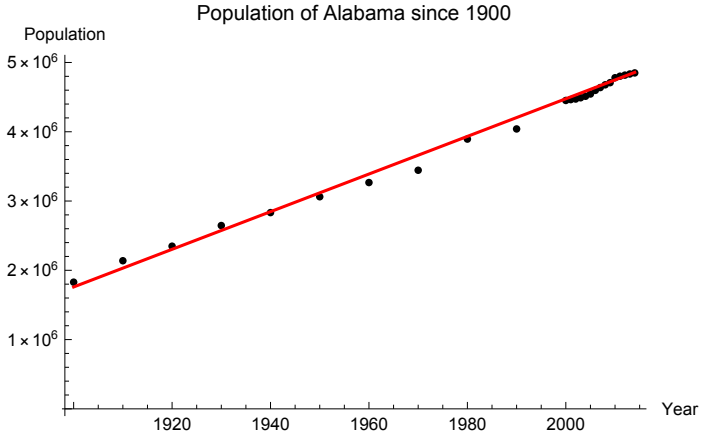
In[70]:=
```
Mmline = Plot[f[x], {x, 1900, 2014}, AxesLabel → {"Year", "Population"},
  PlotStyle → Red, PlotLabel → "Population of Alabama since 1900"]
```

Out[70]=



In[71]:=
```
Show[DataPlot, Mmline]
```

Out[71]=



In[79]:=
```
Residuals = Population - f[Year]
```

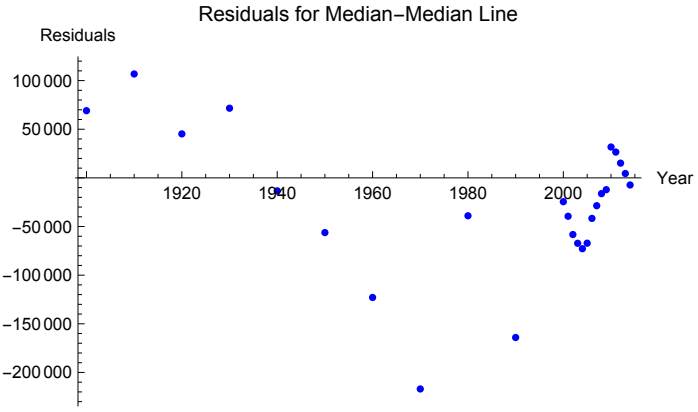
Out[79]=
$$\left\{\frac{31\,285\,946}{453}, \frac{48\,375\,674}{453}, \frac{20\,475\,707}{453}, \frac{32\,436\,569}{453}, -\frac{6\,049\,102}{453}, -\frac{25\,477\,516}{453}, -\frac{55\,680\,535}{453}, -\frac{98\,288\,053}{453}, -\frac{17\,653\,750}{453}, -\frac{74\,327\,824}{453}, -\frac{11\,092\,798}{453}, -\frac{17\,879\,659}{453}, -\frac{26\,387\,467}{453}, -\frac{30\,462\,670}{453}, -\frac{32\,984\,989}{453}, -\frac{30\,406\,528}{453}, -\frac{18\,867\,727}{453}, -\frac{12\,956\,545}{453}, -\frac{7\,342\,531}{453}, -\frac{5\,495\,665}{453}, \frac{14\,373\,353}{453}, \frac{12\,014\,114}{453}, \frac{6\,859\,865}{453}, \frac{2\,033\,135}{453}, -\frac{3\,305\,938}{453}\right\}$$

In[80]:=
```
ResidualPlot = Transpose[{Year, Residuals}]
```

Out[80]=
$$\left\{\left\{1900, \frac{31\,285\,946}{453}\right\}, \left\{1910, \frac{48\,375\,674}{453}\right\}, \left\{1920, \frac{20\,475\,707}{453}\right\}, \left\{1930, \frac{32\,436\,569}{453}\right\},\right.$$
$$\left\{1940, -\frac{6\,049\,102}{453}\right\}, \left\{1950, -\frac{25\,477\,516}{453}\right\}, \left\{1960, -\frac{55\,680\,535}{453}\right\}, \left\{1970, -\frac{98\,288\,053}{453}\right\},$$
$$\left\{1980, -\frac{17\,653\,750}{453}\right\}, \left\{1990, -\frac{74\,327\,824}{453}\right\}, \left\{2000, -\frac{11\,092\,798}{453}\right\},$$
$$\left\{2001, -\frac{17\,879\,659}{453}\right\}, \left\{2002, -\frac{26\,387\,467}{453}\right\}, \left\{2003, -\frac{30\,462\,670}{453}\right\},$$
$$\left\{2004, -\frac{32\,984\,989}{453}\right\}, \left\{2005, -\frac{30\,406\,528}{453}\right\}, \left\{2006, -\frac{18\,867\,727}{453}\right\},$$
$$\left\{2007, -\frac{12\,956\,545}{453}\right\}, \left\{2008, -\frac{7\,342\,531}{453}\right\}, \left\{2009, -\frac{5\,495\,665}{453}\right\}, \left\{2010, \frac{14\,373\,353}{453}\right\},$$
$$\left.\left\{2011, \frac{12\,014\,114}{453}\right\}, \left\{2012, \frac{6\,859\,865}{453}\right\}, \left\{2013, \frac{2\,033\,135}{453}\right\}, \left\{2014, -\frac{3\,305\,938}{453}\right\}\right\}$$

In[81]:=
```
ResidualGraph = ListPlot[ResidualPlot, PlotStyle → Blue,
  AxesLabel → {"Year", "Residuals"}, PlotLabel → "Residuals for Median-Median Line"]
```

Out[81]=



In[83]:=
```
ResidualSum = Total[Residuals]
```

In[84]:=
$$-\frac{306\,804\,934}{453.}$$

Out[84]=
$$-677\,274.$$