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                                      0
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                                                            No n,
                                       1
      "1 LP001003 Male
                             Yes
                                           Graduate
                                                            No \n",
      "2 LP001005 Male
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                                      0
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                                                           Yes \n",
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                                                              No n,
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        ApplicantIncome CoapplicantIncome LoanAmount Loan_Amount_Term \\\n",
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     "1
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                1.0
                         Rural
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                         Urban
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                        Urban
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                                      Y \n"
                        Urban
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   "print(df.head())"
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      "LoanAmount
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      "Loan_Amount_Term
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      "Credit_History
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   "df.isnull().sum()"
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  "df['Married'].fillna(df['Married'].mode()[0], inplace=True)\n",
  "df['Dependents'].fillna(df['Dependents'].mode()[0], inplace=True)\n",
  "df['Self Employed'].fillna(df['Self Employed'].mode()[0], inplace=True)"
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  "df['LoanAmount'].fillna(df['LoanAmount'].median(), inplace=True)\n",
   "\n",
  "# Fill missing values in Loan_Amount_Term with the mode\n",
  "df['Loan Amount Term'].fillna(df['Loan Amount Term'].mode()[0], inplace=True)\n",
   "\n",
   "# Fill missing values in Credit History with the mode\n",
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    "#46039f"
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    "#9c179e"
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    0.55555555555556,
    "#d8576b"
    "#ed7953"
```

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```

```
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```

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```

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```

```
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   "fig_loan_status = px.pie(loan_status_count,\n",
                    names=loan status count.index,\n",
                    title='Loan Approval Status')\n",
   "fig_loan_status.show()"
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     "#9c179e"
     "#bd3786"
```

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    "#d8576b"
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```

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   "#d8576b"
   "#ed7953"
   0.777777777777778,
   "#fb9f3a"
   "#fdca26"
   "#f0f921"
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  "ticks": ""
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   "#0d0887"
   "#46039f"
   0.222222222222,
   "#7201a8"
   0.3333333333333333333
   "#9c179e"
```

```
"#bd3786"
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    "#d8576b"
    "#ed7953"
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    "#fb9f3a"
    "#fdca26"
    "#f0f921"
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    "size": 10,
    "solidity": 0.2
  },
  "type": "histogram"
"histogram2d": [
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   "ticks": ""
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    "#0d0887"
    0.11111111111111111,
    "#46039f"
    0.2222222222222,
```

```
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    "#d8576b"
    "#ed7953"
    0.777777777777778,
    "#fb9f3a"
    0.88888888888888888,
    "#fdca26"
    "#f0f921"
  "type": "histogram2d"
"histogram2dcontour": [
  "colorbar": {
   "outlinewidth": 0,
   "ticks": ""
  "colorscale": [
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    "#0d0887"
    0.11111111111111111,
    "#46039f"
    0.222222222222,
    "#7201a8"
    0.33333333333333333333
```

```
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    "#fb9f3a"
    "#fdca26"
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"scattergeo": [
  "marker": {
   "colorbar": {
     "outlinewidth": 0,
     "ticks": ""
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  "marker": {
   "colorbar": {
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     "ticks": ""
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     "outlinewidth": 0,
     "ticks": ""
  "type": "scatterpolargl"
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     "outlinewidth": 0,
     "ticks": ""
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  "colorbar": {
    "outlinewidth": 0,
    "ticks": ""
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   "#46039f"
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   "#bd3786"
   0.55555555555556,
   "#d8576b"
   "#ed7953"
   0.777777777777778,
   "#fb9f3a"
   "#fdca26"
   "#f0f921"
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  "line": {
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   "arrowwidth": 1
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 "coloraxis": {
   "colorbar": {
    "outlinewidth": 0,
    "ticks": ""
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     0.1,
     "#c51b7d"
     0.2,
     "#de77ae"
     0.3,
     "#f1b6da"
    ],
     0.4,
     "#fde0ef"
     0.5,
      "#f7f7f7"
     0.6,
     "#e6f5d0"
```

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 0.8,
 "#7fbc41"
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 0.222222222222,
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 0.55555555555556,
 "#d8576b"
 "#ed7953"
 0.777777777777778,
 "#fb9f3a"
 "#fdca26"
```

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  0.222222222222,
  "#7201a8"
  0.3333333333333333333
  "#9c179e"
  "#bd3786"
  0.555555555555556,
  "#d8576b"
  "#ed7953"
  0.777777777777778,
  "#fb9f3a"
  "#fdca26"
  "#f0f921"
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"#EF553B"
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"#ab63fa",
"#FFA15A",
"#19d3f3",
```

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 "#FF97FF",
 "#FECB52"
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},
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  "linecolor": "white",
  "ticks": ""
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  "linecolor": "white",
  "ticks": ""
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  "gridcolor": "white",
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   "linecolor": "white",
   "showbackground": true,
  "ticks": "",
   "zerolinecolor": "white"
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   "gridcolor": "white",
  "gridwidth": 2,
   "linecolor": "white",
   "showbackground": true,
  "ticks": "",
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  "linecolor": "white",
   "showbackground": true,
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  "zerolinecolor": "white"
 }
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 "line": {
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  "linecolor": "white",
  "ticks": ""
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 "baxis": {
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  "linecolor": "white",
  "ticks": ""
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 "caxis": {
  "gridcolor": "white",
  "linecolor": "white",
  "ticks": ""
 }
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"xaxis": {
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 "ticks": "",
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 "zerolinewidth": 2
},
"yaxis": {
 "automargin": true,
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 "linecolor": "white",
 "ticks": "",
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          "zerolinewidth": 2
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      "xaxis": {
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        "domain": [
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         1
        "title": {
         "text": "index"
      },
      "yaxis": {
        "anchor": "x",
        "domain": [
         0,
         1
        "title": {
         "text": "y"
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}
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 "fig_gender = px.bar(gender_count,\n",
               x=gender_count.index,\n",
               y=gender_count.values,\n",
               title='Gender Distribution')\n",
 "fig_gender.show()"
"cell_type": "code",
"execution_count": 10,
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  "height": 542
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}, {

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     "config": {
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     "data": [
        "alignmentgroup": "True",
        "hovertemplate": "index=%{x}<br>y=%{y}<extra></extra>",
        "legendgroup": "",
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         "pattern": {
          "shape": ""
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        "name": "",
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        "x": [
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         "No"
        "xaxis": "x",
        "y": [
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         213
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        "yaxis": "y"
     ],
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      "legend": {
        "tracegroupgap": 0
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             "color": "#2a3f5f"
            "marker": {
             "line": {
```

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     "solidity": 0.2
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     "solidity": 0.2
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    "gridcolor": "white",
    "linecolor": "white",
    "minorgridcolor": "white",
    "startlinecolor": "#2a3f5f"
  "baxis": {
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    "gridcolor": "white",
   "linecolor": "white",
   "minorgridcolor": "white",
   "startlinecolor": "#2a3f5f"
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  "colorbar": {
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   "ticks": ""
  "type": "choropleth"
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   "ticks": ""
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    0.11111111111111111,
    "#46039f"
    0.2222222222222,
    "#7201a8"
    0.33333333333333333333
    "#9c179e"
    "#bd3786"
    0.555555555555556,
    "#d8576b"
    "#ed7953"
    0.777777777777778,
    "#fb9f3a"
    "#fdca26"
    "#f0f921"
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"contourcarpet": [
  "colorbar": {
```

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   "ticks": ""
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   "outlinewidth": 0,
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    0.11111111111111111,
    "#46039f"
    0.2222222222222,
    "#7201a8"
    0.3333333333333333333
    "#9c179e"
    "#bd3786"
    0.555555555555556,
    "#d8576b"
    "#ed7953"
    0.777777777777778,
    "#fb9f3a"
    0.888888888888888888,
    "#fdca26"
    "#f0f921"
  "type": "heatmap"
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```
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  "outlinewidth": 0,
  "ticks": ""
  "colorscale": [
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   0.11111111111111111,
   "#46039f"
   0.2222222222222,
   "#7201a8"
   0.33333333333333333333
    "#9c179e"
   "#bd3786"
   0.55555555555556,
   "#d8576b"
   "#ed7953"
   0.777777777777778,
   "#fb9f3a"
   "#fdca26"
    "#f0f921"
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```
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   "outlinewidth": 0,
   "ticks": ""
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    "#0d0887"
    0.11111111111111111,
    "#46039f"
    0.2222222222222,
    "#7201a8"
    0.3333333333333333333
    "#9c179e"
    "#bd3786"
    0.55555555555556,
    "#d8576b"
    "#ed7953"
    0.777777777777778,
    "#fb9f3a"
    "#fdca26"
    1,
```

```
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  "colorbar": {
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   "ticks": ""
  "colorscale": [
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    "#0d0887"
    0.11111111111111111,
    "#46039f"
    0.2222222222222,
    "#7201a8"
    0.3333333333333333333
    "#9c179e"
    "#bd3786"
    0.555555555555556,
    "#d8576b"
    "#ed7953"
    0.777777777777778,
    "#fb9f3a"
    0.888888888888888888,
    "#fdca26"
    "#f0f921"
  "type": "histogram2dcontour"
```

```
"mesh3d": [
  "colorbar": {
    "outlinewidth": 0,
    "ticks": ""
  "type": "mesh3d"
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  "line": {
    "colorbar": {
     "outlinewidth": 0,
     "ticks": ""
   }
  "type": "parcoords"
"pie": [
  "automargin": true,
  "type": "pie"
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    "size": 10,
   "solidity": 0.2
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],
"scatter3d": [
  "line": {
    "colorbar": {
     "outlinewidth": 0,
     "ticks": ""
   }
  "marker": {
    "colorbar": {
     "outlinewidth": 0,
     "ticks": ""
   }
  "type": "scatter3d"
```

```
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  "marker": {
   "colorbar": {
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     "ticks": ""
   }
  "type": "scattercarpet"
"scattergeo": [
  "marker": {
    "colorbar": {
     "outlinewidth": 0,
     "ticks": ""
   }
  "type": "scattergeo"
"scattergl": [
  "marker": {
   "colorbar": {
     "outlinewidth": 0,
     "ticks": ""
  "type": "scattergl"
"scattermapbox": [
  "marker": {
    "colorbar": {
     "outlinewidth": 0,
     "ticks": ""
  "type": "scattermapbox"
"scatterpolar": [
  "marker": {
    "colorbar": {
     "outlinewidth": 0,
     "ticks": ""
   }
  "type": "scatterpolar"
```

```
"scatterpolargl": [
  "marker": {
   "colorbar": {
    "outlinewidth": 0,
    "ticks": ""
  "type": "scatterpolargl"
"scatterternary": [
  "marker": {
   "colorbar": {
    "outlinewidth": 0,
    "ticks": ""
  "type": "scatterternary"
"surface": [
  "colorbar": {
   "outlinewidth": 0,
   "ticks": ""
  "colorscale": [
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    "#0d0887"
    0.11111111111111111,
    "#46039f"
    0.2222222222222,
    "#7201a8"
    0.333333333333333333333
    "#9c179e"
    "#bd3786"
    0.555555555555556,
    "#d8576b"
```

```
"#ed7953"
      0.777777777777778,
      "#fb9f3a"
      "#fdca26"
      "#f0f921"
    "type": "surface"
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 "table": [
   "cells": {
     "fill": {
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     "line": {
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     "fill": {
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     "line": {
      "color": "white"
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  "arrowhead": 0,
  "arrowwidth": 1
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 "coloraxis": {
  "colorbar": {
   "outlinewidth": 0,
   "ticks": ""
  }
 "colorscale": {
  "diverging": [
```

```
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  "#8e0152"
  0.1,
  "#c51b7d"
  0.2,
  "#de77ae"
  0.3,
  "#f1b6da"
  0.4,
  "#fde0ef"
  0.5,
  "#f7f7f7"
  0.6,
  "#e6f5d0"
  0.7,
  "#b8e186"
  0.8,
  "#7fbc41"
  0.9,
  "#4d9221"
  "#276419"
"sequential": [
  "#0d0887"
  0.11111111111111111,
  "#46039f"
```

```
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 "#7201a8"
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 "#bd3786"
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 "#d8576b"
 "#ed7953"
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 "#fb9f3a"
 "#fdca26"
 "#f0f921"
"sequentialminus": [
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 "#0d0887"
 0.11111111111111111,
 "#46039f"
 0.2222222222222,
 "#7201a8"
 0.3333333333333333333
 "#9c179e"
 "#bd3786"
 0.555555555555556,
```

```
"#d8576b"
   "#ed7953"
   0.777777777777778,
   "#fb9f3a"
   "#fdca26"
   1,
   "#f0f921"
"colorway": [
 "#636efa",
 "#EF553B".
 "#00cc96",
 "#ab63fa",
 "#FFA15A",
 "#19d3f3".
 "#FF6692"
 "#B6E880",
 "#FF97FF",
 "#FECB52"
],
"font": {
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},
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 "lakecolor": "white",
 "landcolor": "#E5ECF6",
 "showlakes": true,
 "showland": true,
 "subunitcolor": "white"
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 "align": "left"
"hovermode": "closest",
"mapbox": {
 "style": "light"
"paper_bgcolor": "white",
"plot_bgcolor": "#E5ECF6",
"polar": {
 "angularaxis": {
  "gridcolor": "white",
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```
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  "ticks": ""
 },
 "bgcolor": "#E5ECF6",
 "radialaxis": {
  "gridcolor": "white",
  "linecolor": "white",
  "ticks": ""
},
"scene": {
 "xaxis": {
  "backgroundcolor": "#E5ECF6",
  "gridcolor": "white",
  "gridwidth": 2,
  "linecolor": "white",
  "showbackground": true,
  "ticks": "",
  "zerolinecolor": "white"
 },
 "yaxis": {
  "backgroundcolor": "#E5ECF6",
  "gridcolor": "white",
  "gridwidth": 2,
   "linecolor": "white",
  "showbackground": true,
  "ticks": "",
  "zerolinecolor": "white"
 },
 "zaxis": {
  "backgroundcolor": "#E5ECF6",
  "gridcolor": "white",
  "gridwidth": 2,
  "linecolor": "white",
   "showbackground": true,
  "ticks": "",
  "zerolinecolor": "white"
"shapedefaults": {
 "line": {
  "color": "#2a3f5f"
 }
"ternary": {
 "aaxis": {
  "gridcolor": "white",
  "linecolor": "white",
  "ticks": ""
 "baxis": {
  "gridcolor": "white",
  "linecolor": "white",
  "ticks": ""
 },
```

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    "caxis": {
     "gridcolor": "white",
     "linecolor": "white",
     "ticks": ""
    }
   },
  "title": {
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  },
  "xaxis": {
    "automargin": true,
    "gridcolor": "white",
    "linecolor": "white",
    "ticks": "",
    "title": {
     "standoff": 15
    },
    "zerolinecolor": "white",
    "zerolinewidth": 2
   },
   "yaxis": {
    "automargin": true,
    "gridcolor": "white",
    "linecolor": "white",
    "ticks": "",
    "title": {
     "standoff": 15
    },
    "zerolinecolor": "white",
    "zerolinewidth": 2
 }
"title": {
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"xaxis": {
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   1
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                 y=married_count.values,\n",
                 title='Marital Status Distribution')\n",
   "fig_married.show()"
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     "#46039f"
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   ],
     0.33333333333333333333
     "#9c179e"
     "#bd3786"
```

```
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```

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```

```
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    "#7201a8"
```

```
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    "#d8576b"
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    "#fdca26"
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    0.2222222222222,
    "#7201a8"
    0.33333333333333333333
    "#9c179e"
```

```
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],

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     0.2,
     "#de77ae"
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     "#f1b6da"
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                 y=education_count.values,\n",
                 title='Education Distribution')\n",
 "fig_education.show()"
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],

},

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       "legend": {
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   "#bd3786"
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   "#d8576b"
   "#ed7953"
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   "#fb9f3a"
   0.888888888888888888,
   "#fdca26"
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 "colorbar": {
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   "#d8576b"
   "#ed7953"
   0.777777777777778,
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```
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    "#bd3786"
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    "#d8576b"
   "#ed7953"
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    "#fb9f3a"
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    "#46039f"
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    "#bd3786"
    0.555555555555556,
    "#d8576b"
    "#ed7953"
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    "#fb9f3a"
    0.88888888888888888888888888888888
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    "#f0f921"
```

```
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   "#46039f"
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   "#9c179e"
   "#bd3786"
   0.55555555555556,
   "#d8576b"
   "#ed7953"
   0.777777777777778,
    "#fb9f3a"
   "#fdca26"
    "#f0f921"
 "type": "histogram2dcontour"
```

```
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    "colorbar": {
     "outlinewidth": 0,
     "ticks": ""
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"scattercarpet": [
```

```
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],
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      "outlinewidth": 0,
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   "marker": {
    "colorbar": {
      "outlinewidth": 0,
      "ticks": ""
    }
   "type": "scattermapbox"
"scatterpolar": [
   "marker": {
    "colorbar": {
      "outlinewidth": 0,
      "ticks": ""
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"scatterpolargl": [
```

```
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    "outlinewidth": 0,
    "ticks": ""
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  "type": "scatterpolargl"
"scatterternary": [
  "marker": {
   "colorbar": {
    "outlinewidth": 0,
    "ticks": ""
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"surface": [
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   "outlinewidth": 0,
   "ticks": ""
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    "#0d0887"
    0.11111111111111111,
    "#46039f"
    0.2222222222222,
    "#7201a8"
    0.33333333333333333333
    "#9c179e"
    "#bd3786"
    0.55555555555556,
    "#d8576b"
    "#ed7953"
```

```
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      "#fb9f3a"
      "#fdca26"
      "#f0f921"
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```

```
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  "#c51b7d"
  0.2,
  "#de77ae"
  0.3,
  "#f1b6da"
  0.4,
  "#fde0ef"
  0.5,
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   "\n",
  "# Define the lower and upper bounds for outliers\n",
  "lower_bound = Q1 - 1.5 * IQR\n",
   "upper bound = Q3 + 1.5 * IQR\n",
   "\n",
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#696969;}#sk-container-id-1 label.sk-toggleable label-arrow:hover:before {color:
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black;}#sk-container-id-1 div.sk-toggleable__content {max-height: 0;max-width: 0;overflow:
hidden;text-align: left;background-color: #f0f8ff;}#sk-container-id-1 div.sk-toggleable content pre
{margin: 0.2em;color: black;border-radius: 0.25em;background-color: #f0f8ff;}#sk-container-id-1
input.sk-toggleable__control:checked~div.sk-toggleable__content {max-height: 200px;max-width:
100%; overflow: auto;}#sk-container-id-1
input.sk-toggleable__control:checked~label.sk-toggleable__label-arrow:before {content:
\"\";}#sk-container-id-1 div.sk-estimator input.sk-toggleable control:checked~label.sk-toggleable label
{background-color: #d4ebff;}#sk-container-id-1 div.sk-label
input.sk-toggleable control:checked~label.sk-toggleable label {background-color:
#d4ebff;}#sk-container-id-1 input.sk-hidden--visually {border: 0;clip: rect(1px 1px 1px 1px);clip: rect(1px,
1px, 1px, 1px);height: 1px;margin: -1px;overflow: hidden;padding: 0;position: absolute;width:
```

```
1px;}#sk-container-id-1 div.sk-estimator {font-family: monospace;background-color: #f0f8ff;border: 1px
dotted black;border-radius: 0.25em;box-sizing: border-box;margin-bottom: 0.5em;}#sk-container-id-1
div.sk-estimator:hover {background-color: #d4ebff;}#sk-container-id-1 div.sk-parallel-item::after {content:
\"\";width: 100%;border-bottom: 1px solid gray;flex-grow: 1;}#sk-container-id-1 div.sk-label:hover
label.sk-toggleable label {background-color: #d4ebff;}#sk-container-id-1 div.sk-serial::before {content:
\"\";position: absolute;border-left: 1px solid gray;box-sizing: border-box;top: 0;bottom: 0;left: 50%;z-index:
0;}#sk-container-id-1 div.sk-serial {display: flex;flex-direction: column;align-items:
center; background-color: white; padding-right: 0.2em; padding-left: 0.2em; position:
relative;}#sk-container-id-1 div.sk-item {position: relative;z-index: 1;}#sk-container-id-1 div.sk-parallel
{display: flex;align-items: stretch;justify-content: center;background-color: white;position:
relative;}#sk-container-id-1 div.sk-item::before, #sk-container-id-1 div.sk-parallel-item::before {content:
\"\";position: absolute;border-left: 1px solid gray;box-sizing: border-box;top: 0;bottom: 0;left: 50%;z-index:
-1:}#sk-container-id-1 div.sk-parallel-item {display: flex:flex-direction: column:z-index: 1:position:
relative;background-color: white;}#sk-container-id-1 div.sk-parallel-item:first-child::after {align-self:
flex-end:width: 50%;}#sk-container-id-1 div.sk-parallel-item;last-child;;after {align-self; flex-start;width;
50%;}#sk-container-id-1 div.sk-parallel-item:only-child::after {width: 0;}#sk-container-id-1
div.sk-dashed-wrapped {border: 1px dashed gray;margin: 0 0.4em 0.5em 0.4em;box-sizing:
border-box;padding-bottom: 0.4em;background-color: white;}#sk-container-id-1 div.sk-label label
{font-family: monospace:font-weight: bold;display: inline-block;line-height: 1.2em;}#sk-container-id-1
div.sk-label-container {text-align: center;}#sk-container-id-1 div.sk-container {/* jupyter's 'normalize.less'
sets '[hidden] { display: none; }' but bootstrap.min.css set '[hidden] { display: none !important; }' so we
also need the '!important' here to be able to override the default hidden behavior on the sphinx rendered
scikit-learn.org. See: https://github.com/scikit-learn/scikit-learn/issues/21755 */display: inline-block
!important;position: relative;}#sk-container-id-1 div.sk-text-repr-fallback {display: none;}</style><div
id=\"sk-container-id-1\" class=\"sk-top-container\"><div
class=\"sk-text-repr-fallback\">SVC(random_state=42)<b>In a Jupyter environment, please
rerun this cell to show the HTML representation or trust the notebook. <br />On GitHub, the HTML
representation is unable to render, please try loading this page with nbviewer.org.</b></div><div
class=\"sk-container\" hidden><div class=\"sk-item\"><div class=\"sk-estimator sk-toggleable\"><input
class=\"sk-toggleable__control sk-hidden--visually\" id=\"sk-estimator-id-1\" type=\"checkbox\"
checked><label for=\"sk-estimator-id-1\" class=\"sk-toggleable label
sk-toggleable__label-arrow\">SVC</label><div
class=\"sk-toggleable content\">SVC(random state=42)</div></div></div></div></div>
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     "scaler = StandardScaler()\n",
     "numerical cols = ['ApplicantIncome', 'CoapplicantIncome', 'LoanAmount', 'Loan Amount Term',
'Credit History']\n",
     "X_train[numerical_cols] = scaler.fit_transform(X_train[numerical_cols])\n",
     "X_test[numerical_cols] = scaler.transform(X_test[numerical_cols])\n",
     "\n",
     "\n",
     "model = SVC(random state=42)\n",
     "model.fit(X_train, y_train)"
```

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 "print(y_pred)"
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   "392
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                                           0.305159 \n"
   "537
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                      -0.931554 -0.454950
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     "537
                        Y \n",
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   "# Convert X_test to a DataFrame\n",
   "X_test_df = pd.DataFrame(X_test, columns=X_test.columns)\n",
   "\n",
   "# Add the predicted values to X_test_df\n",
   "X_test_df['Loan_Status_Predicted'] = y_pred\n",
   "print(X_test_df.head())"
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