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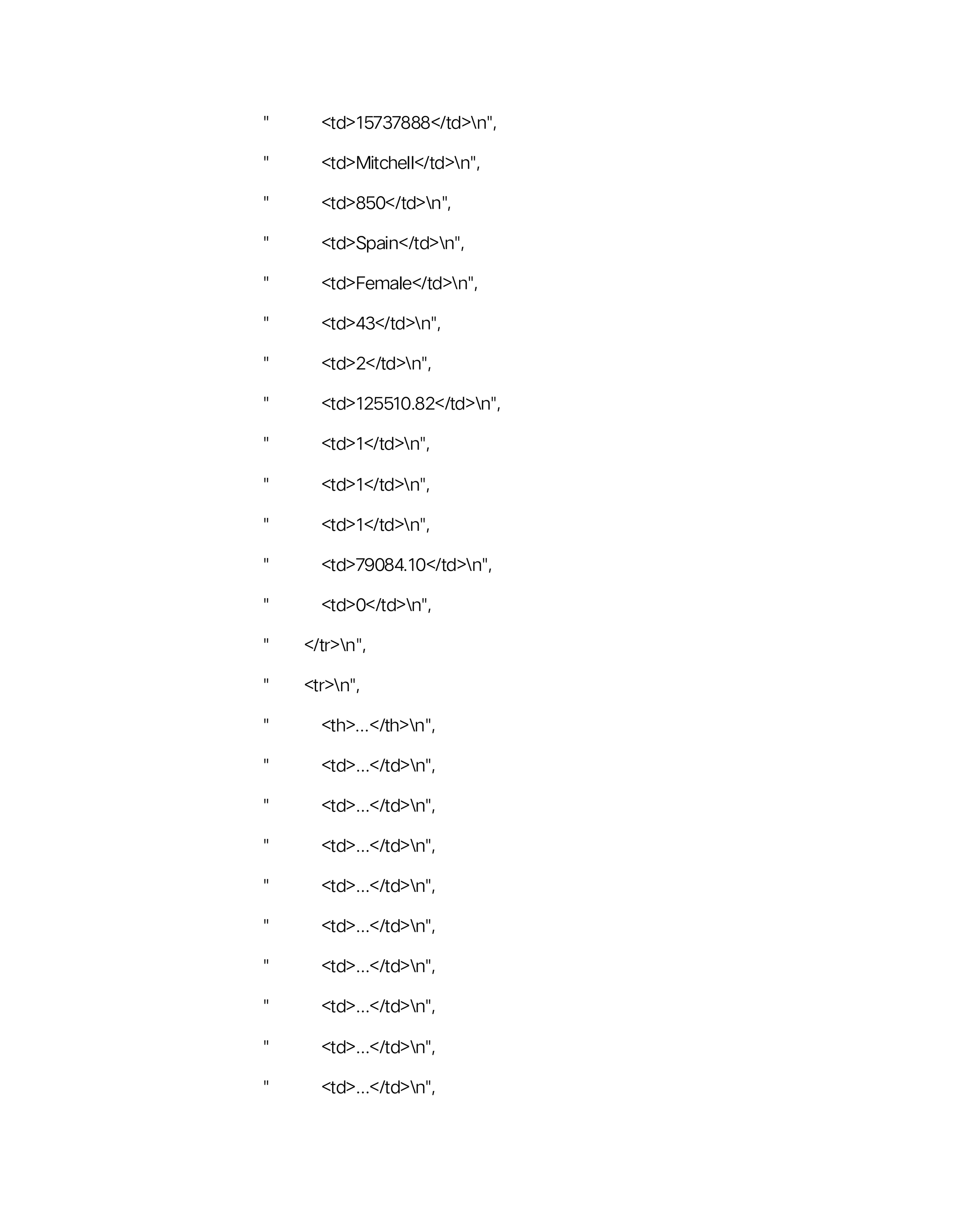

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document.querySelector('#df-5e3f3305-d16c-4e6b-8b55-1b484509a1a6
button.colab-df-convert');\n",
"                buttonEl.style.display =\n",
"                    google.colab.kernel.accessAllowed ? 'block' : 'none';\n",
"\n",
"                async function convertToInteractive(key) {\n",
"                    const element =
document.querySelector('#df-5e3f3305-d16c-4e6b-8b55-1b484509a1a6');\n",
"                    const dataTable =\n",
"                        await
```

```
google.colab.kernel.invokeFunction('convertToInteractive',\n",
                  "                                                                [key], {});\n",
                  "                if (!dataTable) return;\n",
                  "\n",
                  "                const docLinkHtml = 'Like what you see? Visit the ' +\n",
                  "                    '<a target=\"_blank\"
href=https://colab.research.google.com/notebooks/data_table.ipynb>data table
notebook</a>'\n",
                  "                    + ' to learn more about interactive tables.';\n",
                  "                element.innerHTML = '';\n",
                  "                dataTable['output_type'] = 'display_data';\n",
                  "                await google.colab.output.renderOutput(dataTable,
element);\n",
                  "                const docLink = document.createElement('div');\n",
                  "                docLink.innerHTML = docLinkHtml;\n",
                  "                element.appendChild(docLink);\n",
                  "            }\n",
                  "        </script>\n",
                  "    </div>\n",
                  "    "
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```
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        "pd.isnull(data[\"Gender\"])"
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  "data": {
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      "1       False\n",
      "2       False\n",
      "3       False\n",
      "4       False\n",
```

```
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            "9995       False\n",
            "9996       False\n",
            "9997       False\n",
            "9998       False\n",
            "9999       False\n",
            "Name: Gender, Length: 10000, dtype: bool"
        ]
      },
      "metadata": {},
      "execution_count": 11
    }
  ]
},
{
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  "source": [
    "df[\"Tenure\"] = np.where(df[\"Tenure\"] >10, np.median,df[\"Tenure\"])\n",
    "df[\"Tenure\"]"
  ],
  "metadata": {
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    },
    "id": "kuLsHda8IrxZ",
```

```
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},
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                "3        1\n",
                "4        2\n",
                "        ..\n",
                "9995     5\n",
                "9996    10\n",
                "9997     7\n",
                "9998     3\n",
                "9999     4\n",
                "Name: Tenure, Length: 10000, dtype: object"
            ]
        },
        "metadata": {},
        "execution_count": 12
    }
```

```
      ]
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        "pd.get_dummies(df, columns=[\"Gender\", \"Age\"], prefix=[\"Age\", \"Gender\"]).head()"
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              "   RowNumber  CustomerId   Surname  CreditScore Geography  Tenure  Balance  \\\n",
              "0          1    15634602  Hargrave          619    France       2     0.00   \n",
              "1          2    15647311      Hill          608     Spain       1
```

```
83807.86     \n",
                    "2            3      15619304          Onio                 502       France
8   159660.80     \n",
                    "3            4      15701354          Boni                 699       France
1          0.00     \n",
                    "4            5      15737888      Mitchell                 850       Spain
2   125510.82     \n",
                    "\n",
                    "     NumOfProducts  HasCrCard  IsActiveMember  ...  Gender_78
Gender_79   \\\n",
                    "0                1          1               1  ...          0
0     \n",
                    "1                1          0               1  ...          0
0     \n",
                    "2                3          1               0  ...          0
0     \n",
                    "3                2          0               0  ...          0
0     \n",
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0     \n",
                    "\n",
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Gender_85   \\\n",
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0     \n",
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0     \n",
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0     \n",
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0     \n",
```

```
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0     \n",
                "\n",
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                "        <div class=\"colab-df-container\">\n",
                "            <div>\n",
                "<style scoped>\n",
                "        .dataframe tbody tr th:only-of-type {\n",
                "                vertical-align: middle;\n",
                "        }\n",
                "\n",
                "        .dataframe tbody tr th {\n",
                "                vertical-align: top;\n",
                "        }\n",
                "\n",
```

```
"        .dataframe thead th {\n",
"            text-align: right;\n",
"        }\n",
"</style>\n",
"<table border=\"1\" class=\"dataframe\">\n",
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"        <tr style=\"text-align: right;\">\n",
"            <th></th>\n",
"            <th>RowNumber</th>\n",
"            <th>CustomerId</th>\n",
"            <th>Surname</th>\n",
"            <th>CreditScore</th>\n",
"            <th>Geography</th>\n",
"            <th>Tenure</th>\n",
"            <th>Balance</th>\n",
"            <th>NumOfProducts</th>\n",
"            <th>HasCrCard</th>\n",
"            <th>IsActiveMember</th>\n",
"            <th>...</th>\n",
"            <th>Gender_78</th>\n",
"            <th>Gender_79</th>\n",
"            <th>Gender_80</th>\n",
"            <th>Gender_81</th>\n",
"            <th>Gender_82</th>\n",
"            <th>Gender_83</th>\n",
```

```
"          <th>Gender_84</th>\n",
"          <th>Gender_85</th>\n",
"          <th>Gender_88</th>\n",
"          <th>Gender_92</th>\n",
"        </tr>\n",
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"          <td>France</td>\n",
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"          <td>0</td>\n",
```

```
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"          <td>2</td>\n",
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"          <td>0</td>\n",
"          <td>0</td>\n",
```

```
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"            <td>502</td>\n",
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```

```
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"          <td>0.00</td>\n",
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"          <td>0</td>\n",
"          <td>0</td>\n",
"          <td>0</td>\n",
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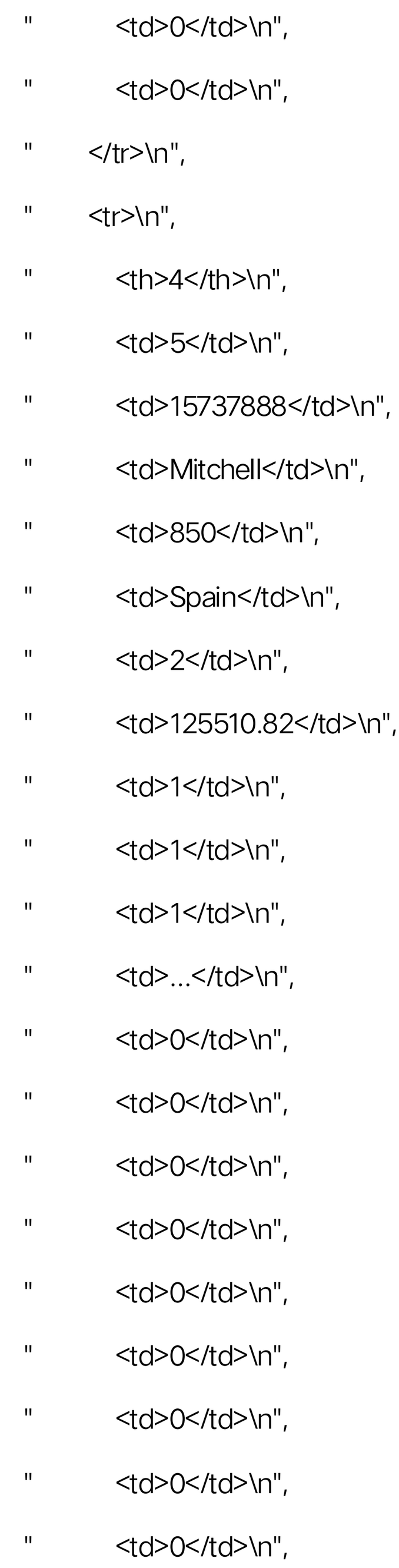

```
"            <td>0</td>\n",
"        </tr>\n",
"    </tbody>\n",
"</table>\n",
"<p>5 rows × 84 columns</p>\n",
"</div>\n",
"            <button class=\"colab-df-convert\"
onclick=\"convertToInteractive('df-a9c64075-2157-409f-82ea-a825a6427114')\"\n",
"                    title=\"Convert this dataframe to an interactive table.\"\n",
"                    style=\"display:none;\">\n",
"                \n",
"    <svg xmlns=\"http://www.w3.org/2000/svg\"
height=\"24px\"viewBox=\"0 0 24 24\"\n",
"            width=\"24px\">\n",
"        <path d=\"M0 0h24v24H0V0z\" fill=\"none\"/>\n",
"        <path d=\"M18.56 5.44l.94 2.06.94-2.06
2.06-.94-2.06-.94-.94-2.06-.94 2.06-2.06.94zm-11 1L8.5 8.5l.94-2.06
2.06-.94-2.06-.94L8.5 2.5l-.94 2.06-2.06.94zm10 10l.94 2.06.94-2.06 2.06-.94-2.06-.94-.
94-2.06-.94 2.06-2.06.94z\"/><path d=\"M17.41 7.96l-1.37-1.37c-.4-.4-.92-.59-1.43-.59-.
52 0-1.04.2-1.43.59L10.3 9.45l-7.72 7.72c-.78.78-.78 2.05 0 2.83L4 21.41c.39.39.9.59
1.41.59.51 0 1.02-.2 1.41-.59l7.78-7.78 2.81-2.81c.8-.78.8-2.07 0-2.86zM5.41 20L4
18.59l7.72-7.72 1.47 1.35L5.41 20z\"/>\n",
"    </svg>\n",
"            </button>\n",
"            \n",
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```

```
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"            border-radius: 50%;\n",
"            cursor: pointer;\n",
"            display: none;\n",
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"            height: 32px;\n",
"            padding: 0 0 0 0;\n",
"            width: 32px;\n",
"        }\n",
"\n",
"        .colab-df-convert:hover {\n",
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"            box-shadow: 0px 1px 2px rgba(60, 64, 67, 0.3), 0px 1px 3px 1px
rgba(60, 64, 67, 0.15);\n",
"            fill: #174EA6;\n",
"        }\n",
"\n",
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```

```
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"\n",
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"            filter: drop-shadow(0px 1px 2px rgba(0, 0, 0, 0.3));\n",
"            fill: #FFFFFF;\n",
"        }\n",
"    </style>\n",
"\n",
"        <script>\n",
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"
document.querySelector('#df-a9c64075-2157-409f-82ea-a825a6427114 button.colab-df-
convert');\n",
"            buttonEl.style.display =\n",
"                google.colab.kernel.accessAllowed ? 'block' : 'none';\n",
"\n",
"            async function convertToInteractive(key) {\n",
"                const element =
document.querySelector('#df-a9c64075-2157-409f-82ea-a825a6427114');\n",
"                const dataTable =\n",
"                    await
google.colab.kernel.invokeFunction('convertToInteractive',\n",
"                                                [key], {});\n",
"                if (!dataTable) return;\n",
"\n",
```

```
          "                const docLinkHtml = 'Like what you see? Visit the ' +\n",
          "                    '<a target=\"_blank\" href=https://colab.research.google.com/notebooks/data_table.ipynb>data table notebook</a>'\n",
          "                    + ' to learn more about interactive tables.';\n",
          "                element.innerHTML = '';\n",
          "                dataTable['output_type'] = 'display_data';\n",
          "                await google.colab.output.renderOutput(dataTable, element);\n",
          "                const docLink = document.createElement('div');\n",
          "                docLink.innerHTML = docLinkHtml;\n",
          "                element.appendChild(docLink);\n",
          "            }\n",
          "        </script>\n",
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          "  </div>\n",
          "  "
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    }
  ]
},
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```

```
    "X = df.iloc[:, :-2].values\n",
    "print(X)"
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    "outputId": "9281cc13-81eb-4ace-e8ee-0b5ef7b16c8f"
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        "name": "stdout",
        "text": [
            "[[1 15634602 'Hargrave' ... 1 1 1]\n",
            " [2 15647311 'Hill' ... 1 0 1]\n",
            " [3 15619304 'Onio' ... 3 1 0]\n",
            " ...\n",
            " [9998 15584532 'Liu' ... 1 0 1]\n",
            " [9999 15682355 'Sabbatini' ... 2 1 0]\n",
            " [10000 15628319 'Walker' ... 1 1 0]]\n"
    ]
}
```

```
        ]
      },
      {
        "cell_type": "code",
        "source": [
          "import pandas as pd\n",
          "df = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/downloads/Churn_Modelling.csv')\n",
          "Y = df.iloc[:, -1].values\n",
          "print(Y)"
        ],
        "metadata": {
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          },
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          "outputId": "612b517b-9792-4aae-e0b9-56027f6f2d45"
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            "name": "stdout",
            "text": [
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            ]
```

```
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      "scaler=MinMaxScaler()"
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    },
    "execution_count": 17,
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  {
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      "print(df)"
    ],
  ],
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```

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        "name": "stdout",
        "text": [
          "      RowNumber    CustomerId       Surname    CreditScore Geography
Gender    Age    \\\n",
          "0           0.0000    15634602    Hargrave           619       France
Female    42     \n",
          "1           0.0001    15647311        Hill           608        Spain
Female    41     \n",
          "2           0.0002    15619304        Onio           502       France
Female    42     \n",
          "3           0.0003    15701354        Boni           699       France
Female    39     \n",
          "4           0.0004    15737888    Mitchell           850        Spain
Female    43     \n",
          "...            ...         ...         ...         ...          ...    ...
\n",
          "9995        0.9996    15606229    Obijiaku           771       France
Male      39     \n",
          "9996        0.9997    15569892    Johnstone          516       France
Male      35     \n",
          "9997        0.9998    15584532          Liu          709       France
Female    36     \n",
```

```
"9998  0.9999  15682355  Sabbatini  772  Germany  Male  42  \n",
"9999  1.0000  15628319  Walker  792  France  Female  28  \n",
"\n",
"  Tenure  Balance  NumOfProducts  HasCrCard  IsActiveMember  \\\n",
"0  2  0.00  1  1  1  \n",
"1  1  83807.86  1  0  1  \n",
"2  8  159660.80  3  1  0  \n",
"3  1  0.00  2  0  0  \n",
"4  2  125510.82  1  1  1  \n",
"...  ...  ...  ...  ...  ...  \n",
"9995  5  0.00  2  1  0  \n",
"9996  10  57369.61  1  1  1  \n",
"9997  7  0.00  1  0  1  \n",
"9998  3  75075.31  2  1  0  \n",
"9999  4  130142.79  1  1  0  \n",
"\n",
"  EstimatedSalary  Exited  \n",
```

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"2                    113931.57               1    \n",
"3                     93826.63               0    \n",
"4                     79084.10               0    \n",
"...                        ...             ...    \n",
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"9996                 101699.77               0    \n",
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"\n",
"[10000 rows x 14 columns]\n"
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"X = df.drop(columns = ['Tenure']).copy()\n",
"y = df['Tenure']\n",
"X_train, X_rem, y_train, y_rem = train_test_split(X,y, train_size=0.8)\n",
```

```
      "test_size = 0.5\n",
      "X_valid, X_test, y_valid, y_test = train_test_split(X_rem,y_rem, test_size=0.5)\n",
      "print(X_train.shape), print(y_train.shape)\n",
      "print(X_valid.shape), print(y_valid.shape)\n",
      "print(X_test.shape), print(y_test.shape)"
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          "(8000,)\n",
          "(1000, 13)\n",
          "(1000,)\n",
          "(1000, 13)\n",
          "(1000,)\n"
```

```
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