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        "Компания UNICEF, чья миссия состоит в повышении уровня благополучия детей по всему миру, стремится выявлять студентов, находящихся в группе риска, на ранней стадии, отслеживая влияние условий жизни учащихся в возрасте от 15 до 22 лет на их успеваемость по математике.\n",
        "\n",
        "В этом проекте мне нужно:\n",
        "\n",
        "    Проверить качество данных и очистить их, если это необходимо.\n",
        "    Сформулировать предположения и гипотезы для дальнейшего построения модели, которая\n",
        "    предсказывала бы результаты госэкзамена по математике для каждого ученика школы.\n",
        "    Определиться с параметрами модели.\n",
        "    Составить отчёт по результатам разведывательного анализа."
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"\n",
"13 колонок содержат числовые (количественные) данные;\n",
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    "metadata": {},
    "source": [
      "Только три колонки ('school', 'sex', 'age') не имеют пропусков."
    ]
  },
  "\n",
```

```
    "\n",
    "Колонки 'famsize', 'Pstatus', 'Fedu', 'Fjob', 'guardian',
    'traveltime', 'failures', 'famsup', 'paid', 'higher', 'internet',
    'romantic', 'famrel' имеют более 20 пропусков, уже имеют значение
    NaN. Сейчас не будем их заменять, сначала изучим данные и посмотрим,
    можно ли эти пропуски заполнить, удалить или оставить в значении
    None."
  ],
```

```
  {
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    "metadata": {},
    "source": [
      "Изучим наименование колонок, возможно некоторые нужно
      переименовать для удобства."
    ]
  },
```

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        "data": {
```

```

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'Pstatus', 'Medu', 'Fedu',\n",
            "            'Mjob', 'Fjob', 'reason', 'guardian', 'traveltime',
'studytime',\n",
            "            'failures', 'schoolsup', 'famsup', 'paid',
'activities', 'nursery',\n",
            "            'studytime, granular', 'higher', 'internet',
'romantic', 'famrel',\n",
            "            'freetime', 'goout', 'health', 'absences', 'score'],
\n",
            "            dtype='object')"
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            "stud_math.columns"
        ],
        "cell_type": "code",
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        "metadata": {},
        "outputs": [],
        "source": [
            "# Переименуем столбец 'studytime, granular' и 'go_out' для
удобства.\n",
            "stud_math.columns = ['school', 'sex', 'age', 'address',
'famsize', 'Pstatus', 'Medu', 'Fedu',\n",
            "            'Mjob', 'Fjob', 'reason', 'guardian',
'traveltime', 'studytime',\n",
            "            'failures', 'schoolsup', 'famsup', 'paid',
'activities', 'nursery',\n",
            "            'studytime_granular', 'higher',
'internet', 'romantic', 'famrel',\n",
            "            'freetime', 'go_out', 'health',
'absences', 'score']"
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            "8 из 17 колонок ('schoolsup', 'famsup', 'paid', 'activities',
'nursery', 'higher', 'internet', 'romantic'), имеющих категориальные
данные имеют значения Yes или No, для удобства обработки данных
заменяем их на числовые: Yes = 1, No = 0."
        ]
    },

```

```

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    "def get_sup(x): \n",
    "    if x == 'yes':\n",
    "        return 1\n",
    "    if x == 'no':\n",
    "        return 0\n",
    "    else:\n",
    "        return x"
]
},
{
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    "metadata": {},
    "outputs": [],
    "source": [
        "stud_math.schoolsup = stud_math.schoolsup.apply(get_sup)"
    ]
},
{
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        "stud_math.famsup = stud_math.famsup.apply(get_sup)"
    ]
},
{
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    "metadata": {},
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    "source": [
        "stud_math.paid = stud_math.paid.apply(get_sup)"
    ]
},
{
    "cell_type": "code",
    "execution_count": 14,
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        "stud_math.activities = stud_math.activities.apply(get_sup)"
    ]
},
{
    "cell_type": "code",
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```



```

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},
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},
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},
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    ]
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                    "<style scoped>\n",
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                    "        vertical-align: middle;\n",
                    "    }\n",

```

```

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"    }\n",
"\n",
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"        text-align: right;\n",
"    }\n",
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"            <th>Mjob</th>\n",
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"    </thead>\n",
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"            <th>other</th>\n",
"            <td>133</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>services</th>\n",
"            <td>98</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>at_home</th>\n",
"            <td>58</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>teacher</th>\n",
"            <td>55</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>health</th>\n",
"            <td>32</td>\n",
"        </tr>\n",
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"</table>\n",
"</div>"
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"other    133\n",
"services    98\n",
"at_home    58\n",
"teacher    55\n",
"health     32"
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  "RangeIndex: 395 entries, 0 to 394\n",
  "Data columns (total 1 columns):\n",
  " #   Column  Non-Null Count  Dtype  \n",
  " ---  ---      -
  " 0    Mjob    376 non-null    object\n",
  "dtypes: object(1)\n",
  "memory usage: 3.2+ KB\n"
]
},
],
"source": [
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  "display(pd.DataFrame(stud_math.Mjob.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
  "      (stud_math.Mjob.value_counts() > 10).sum())\n",
  "stud_math.loc[:, ['Mjob']].info()"
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},
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  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
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          "        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",
    "    <thead>\n",
    "        <tr style='text-align: right;'>\n",
    "            <th></th>\n",
    "            <th>school</th>\n",
    "        </tr>\n",
    "    </thead>\n",
    "    <tbody>\n",
    "        <tr>\n",
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    "            <td>349</td>\n",
    "        </tr>\n",
    "        <tr>\n",
    "            <th>MS</th>\n",
    "            <td>46</td>\n",
    "        </tr>\n",
    "    </tbody>\n",
    "</table>\n",
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    "text/plain": [
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        "GP      349\n",
        "MS       46"
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    "RangeIndex: 395 entries, 0 to 394\n",
    "Data columns (total 1 columns):\n",
    " #   Column  Non-Null Count  Dtype \n",
    "___  _\n",
    " 0   school  395 non-null      object\n",
    "dtypes: object(1)\n",
    "memory usage: 3.2+ KB"
  ]
}
],
"source": [
  "pd.DataFrame(stud_math.school.value_counts())\n",

```

```

"display(pd.DataFrame(stud_math.school.value_counts()))\n",
"print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
"      (stud_math.school.value_counts() > 10).sum())\n",
"stud_math.loc[:, ['school']].info()"
]
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    "labels = ['GP', 'MS']\n",
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    "Вывод: при имеющемся количестве данных данный показатель не будет влиять на предсказываемую величину."
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нет. Данные содержат информацию об принадлежности учеников к полу
(женский/мужской): учеников обоих полов примерно поровну. Так же мы
можем оценить, что ученики мужского пола в среднем имеют баллы по
колонке 'score' выше, чем ученики женского пола, но не значительно.
\n",
"Вывод: по имеющимся данным это показательно не значительно ,
будет влиять на предсказываемую величину."
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    лет включительно, так же мы видим что в среднем ученики 15–17 лет  

    получают более высокие баллы. Данных же об учениках старше 19 лет  

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        "grouped_address = stud_math.groupby(\n",
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```

```

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 "quant_25_Medu = stud_math.Medu.quantile(0.25)\n",
 "quant_75_Medu = stud_math.Medu.quantile(0.75)\n",

```

    "print('25-й перцентиль: {}, 75-й перцентиль: {}, IQR: {},
Границы выбросов [{}, {}]'.format(\n",
    "    quant_25_Medu, quant_75_Medu, IQR_Medu, quant_25_Medu -
1.5*IQR_Medu, quant_75_Medu + 1.5*IQR_Medu))\n",
    "stud_math.Medu.loc[stud_math.Medu.between(\n",
    "    quant_25_Medu - 1.5*IQR_Medu, quant_75_Medu +
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                "1.0    43.125000\n",
                "Name: score, dtype: float64\n"
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        "# Оценим средние значения об успеваемости в зависимости от
уровня образования матери ученика.\n",
        "grouped_Medu = stud_math.groupby(\n",
        "    ['Medu'])['score'].mean().sort_values(ascending=False)\n",
        "print(grouped_Medu)"
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\n",
        "Так же мы видим, что у учеников, чья мать не имеет образования
имеют в среднем высокие баллы, однако и ученики, чьи матери имеют
высшее образование, так же имеют в среднем высокие баллы. Используем
эти данные. "
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```



```

]
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        "#    Column  Non-Null Count  Dtype  \n",
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      возможно заменить пропуски средним или медиальным статистическим
      значением). Как мы видим уровень образования отцов ниже уровня
      образования матерей: более половины отцов учеников имеют
      неоконченное школьное или среднее образование. Так же мы видим
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      "\n",
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      "2. Проверим на наличие выбросов и при необходимости удалим их;
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по аналогии с уровнем образования матери, я понимаю, что эта\n",
информация важна. Опираясь на здравый смысл заменим значение '40' на\n",
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среднем высокие баллы, однако и ученики, чей отец имеет высшее
образование, так же имеют в среднем высокие баллы. Используем эти
данные."
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  {
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'other' – другое)"
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```

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  "labels = ['other', 'services', 'at_home', 'teacher', 'health']
\n",
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  "ax.pie(vals, labels=labels, autopct='%1.1f%%')\n",
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```

```

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"RangeIndex: 395 entries, 0 to 394\n",
"Data columns (total 1 columns):\n",
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"---  -
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```

```

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Колонка содержит категоральные данные, 395 строк, есть пропуски (36). Информации, для их заполнения нет, или возможно заполнить эти данные как другое или 'без работы'. Данные содержат информацию об сфере деятельности отца учащихся. Посмотрим какими данными заполнена эта колонка по долям и влияет ли это на уровень образования их детей."

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umniYuLY/369Tz77LM88cQTKW21kzEWFBSwb06Hn/
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NtcSrZ+QcXBTdS0kyI0lsL1C4n6+yf0jejBwZxjV1zeQ2vksdi76RYac9XX2/3798fPz
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T18ub/
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2K4U/
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```

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mzcPgEWLFmE2m1m5ciVQ03ZWSkoKw4cP59VXX+W3335jxIgr3HjjjY1+7IJwLVwi4H37
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C4uDj+8Y9/sHr1ajQaDa+88grh4eG8/
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YALghsTARcENyYCLghuTARcENyYCLgguDERcEFwYyLgguDGRMAFwY2JgAuCGxMBFwQ3J
gIuCG5MBFwQ3Nj/A+3x4N3lsjmeAAAAAElFTkSuQmCC\n",

```

```

    "text/plain": [
        "<Figure size 432x288 with 1 Axes>"
    ],
    "metadata": {},
    "output_type": "display_data"
},
"source": [
    "# Посмотрим какими данными заполнена эта колока по долям.\n",
    "vals = stud_math.Fjob.value_counts()\n",
    "labels = ['other', 'services', 'at_home', 'teacher', 'health']\n",
    "\n",
    "\n",
    "fig, ax = plt.subplots()\n",
    "ax.pie(vals, labels=labels, autopct='%1.1f%%')\n",
    "ax.axis()"
],
},
{
    "cell_type": "markdown",
    "metadata": {},
    "source": [
        "Мы видим, что в большинстве случаев сфера деятельности не  
указана, заменим пропущенные данные на 'other'."
    ],
},
{
    "cell_type": "code",
    "execution_count": 56,
    "metadata": {},
    "outputs": [],
    "source": [
        "stud_math.loc[(stud_math['Fjob'].isnull()), 'Fjob'] = 'other'"
    ],
},

```

```

{
  "cell_type": "code",
  "execution_count": 57,
  "metadata": {},
  "outputs": [
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      "output_type": "stream",
      "text": [
        "Fjob\n",
        "teacher      59.827586\n",
        "health       55.666667\n",
        "other        51.891304\n",
        "at_home      51.875000\n",
        "services     50.454545\n",
        "Name: score, dtype: float64\n"
      ]
    },
    {
      "source": [
        "# Оценим средние значения об успеваемости в зависимости от
сферы работы матери ученика.\n",
        "grouped_Fjob = stud_math.groupby(\n",
        "    ['Fjob'])['score'].mean().sort_values(ascending=False)\n",
        "print(grouped_Fjob)"
      ]
    },
    {
      "cell_type": "markdown",
      "metadata": {},
      "source": [
        "Мы видим, что данные из колонок, содержащих информацию о сфере
деятельности родителей учеников схожи: ученики, чьи родители
работают в сфере образования или здравоохранения в среднем получают
более высокие балы."
      ]
    },
    {
      "cell_type": "markdown",
      "metadata": {},
      "source": [
        "# Reason"
      ]
    },
    {
      "cell_type": "markdown",
      "metadata": {},
      "source": [
        "причина выбора школы ('home' – близость к дому, 'reputation' –
репутация школы, 'course' – образовательная программа, 'other' –
другое)"
      ]
    }
  ],
  "source": [
    "# Reason"
  ]
}

```

```

"cell_type": "code",
"execution_count": 58,
"metadata": {},
"outputs": [
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      "<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",
      "  <thead>\n",
      "    <tr style=\"text-align: right;\">\n",
      "      <th></th>\n",
      "      <th>reason</th>\n",
      "    </tr>\n",
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      "  <tbody>\n",
      "    <tr>\n",
      "      <th>course</th>\n",
      "      <td>137</td>\n",
      "    </tr>\n",
      "    <tr>\n",
      "      <th>home</th>\n",
      "      <td>104</td>\n",
      "    </tr>\n",
      "    <tr>\n",
      "      <th>reputation</th>\n",
      "      <td>103</td>\n",
      "    </tr>\n",
      "    <tr>\n",
      "      <th>other</th>\n",
      "      <td>34</td>\n",
      "    </tr>\n",
      "  </tbody>\n",
      "</table>\n",
      "</div>"
    ],
    "text/plain": [
      "reason\n",
      "course      137\n",
      "home        104\n",
      "reputation   103

```



```

        "other"          34"
    ]
},
"metadata": {},
"output_type": "display_data"
},
{
    "name": "stdout",
    "output_type": "stream",
    "text": [
        "Значений, встретившихся в столбце более 10 раз: 4\n",
        "<class 'pandas.core.frame.DataFrame'>\n",
        "RangeIndex: 395 entries, 0 to 394\n",
        "Data columns (total 1 columns):\n",
        "#      Column  Non-Null Count  Dtype  \n",
        "---  -
        0      reason  378 non-null    object\n",
        "dtypes: object(1)\n",
        "memory usage: 3.2+ KB\n"
    ]
}
],
"source": [
    "pd.DataFrame(stud_math.reason.value_counts())\n",
    "display(pd.DataFrame(stud_math.reason.value_counts()))\n",
    "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
    "      (stud_math.reason.value_counts() > 10).sum())\n",
    "stud_math.loc[:, ['reason']].info()"
]
},
{
    "cell_type": "markdown",
    "metadata": {},
    "source": [
        "Колонка содержит категоральные данные, 395 строк, есть пропуски (17). Данные содержат информацию о критериях, по которым была выбрана школа. Соответственно данный критерии будет влиять на выбор школы. Мы уже знаем, что в данных информация об учениках всего 2х школ, при этом данные одной из школ занимают только около 10%, соответственно эта информация не может повлиять на предсказываемую величину. \n",
        "Вывод: при имеющемся количестве данных данный показатель не будет влиять на предсказываемую величину, удалим его."
    ]
},
{
    "cell_type": "code",
    "execution_count": 59,
    "metadata": {},
    "outputs": [],
    "source": [
        "stud_math.drop(['reason'], inplace = True, axis = 1)"
    ]
}
],

```

```

{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "# Guardian "
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "опекун ('mother' - мать, 'father' - отец, 'other' - другое)"
  ]
},
{
  "cell_type": "code",
  "execution_count": 60,
  "metadata": {},
  "outputs": [
    {
      "data": {
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          "<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",
          "  <thead>\n",
          "    <tr style='text-align: right;'>\n",
          "      <th></th>\n",
          "      <th>guardian</th>\n",
          "    </tr>\n",
          "  </thead>\n",
          "  <tbody>\n",
          "    <tr>\n",
          "      <th>mother</th>\n",
          "      <td>250</td>\n",
          "    </tr>\n",
          "    <tr>\n",
          "      <th>father</th>\n",
          "      <td>86</td>\n",
          "    </tr>\n",
          "    <tr>\n",
          "      <th>other</th>\n",

```

```

        <td>28</td>\n",
        </tr>\n",
    </tbody>\n",
</table>\n",
</div>
],
"text/plain": [
    guardian\n",
    mother      250\n",
    father       86\n",
    other        28
]
},
"metadata": {},
"output_type": "display_data"
},
{
    "name": "stdout",
    "output_type": "stream",
    "text": [
        "Значений, встретившихся в столбце более 10 раз: 3\n",
        "<class 'pandas.core.frame.DataFrame'>\n",
        "RangeIndex: 395 entries, 0 to 394\n",
        "Data columns (total 1 columns):\n",
        "#      Column      Non-Null Count  Dtype \n",
        "---  -
        0      guardian  364 non-null    object\n",
        "dtypes: object(1)\n",
        "memory usage: 3.2+ KB\n"
    ]
}
],
"source": [
    "pd.DataFrame(stud_math.guardian.value_counts())\n",
    "display(pd.DataFrame(stud_math.guardian.value_counts()))\n",
    "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
    "      (stud_math.guardian.value_counts() > 10).sum())\n",
    "stud_math.loc[:, ['guardian']].info()"
]
},
{
    "cell_type": "code",
    "execution_count": 61,
    "metadata": {},
    "outputs": [
        {
            "name": "stdout",
            "output_type": "stream",
            "text": [
                guardian\n",
                father      53.430233\n",
                mother      52.600806\n",
                other       45.625000\n",
                Name: score, dtype: float64\n"
            ]
        }
    ]
}

```

```

    ]
  },
  {
    "cell_type": "code",
    "execution_count": 62,
    "metadata": {},
    "outputs": [],
    "source": [
      "# Оценим средние значения об успеваемости в зависимости от
      # уровня образования матери ученика.\n",
      "grouped_guardian = stud_math.groupby(\n",
      "    ['guardian'])['score'].mean().sort_values(ascending=False)\n",
      "\n",
      "print(grouped_guardian)"
    ]
  },
  {
    "cell_type": "text",
    "metadata": {},
    "source": [
      "Колонка содержит категоральные данные, 395 строк, есть пропуски  

      (31 – это значительно, около 10% данных в этой категории).  

      Информации, для их заполнения нет. Данные содержат информацию об  

      опекунах учеников. Учеников, чьи опекуны не являются родителями,  

      менее 10%. При этом мы видим, что есть разница в среднем в баллах по  

      колонке 'score' между этими учениками.\n",
      "\n",
      "Попробуем оцифровать данный показатель, где 0 – опекуном  

      является родитель ученика (мать или отец) и 1 – опекуном являются  

      третьи лица "
    ]
  },
  {
    "cell_type": "code",
    "execution_count": 63,
    "metadata": {},
    "outputs": [],
    "source": [
      "def get_guardian(x):\n",
      "    if x == None:\n",
      "        return None\n",
      "    if x == 'other':\n",
      "        return 1\n",
      "    else:\n",
      "        return 0"
    ]
  },
  {
    "cell_type": "code",
    "execution_count": 64,
    "metadata": {},
    "outputs": [],
    "source": [
      "stud_math.guardian = stud_math.guardian.apply(get_guardian)"
    ]
  },
  {
    "cell_type": "code",
    "execution_count": 65,
    "metadata": {},
    "outputs": [],
    "source": [
      "# Оценим средние значения об успеваемости в зависимости от
      # уровня образования матери ученика.\n",
      "grouped_guardian = stud_math.groupby(\n",
      "    ['guardian'])['score'].mean().sort_values(ascending=False)\n",
      "\n",
      "print(grouped_guardian)"
    ]
  }
]

```

```

"execution_count": 64,
"metadata": {},
"outputs": [
  {
    "name": "stdout",
    "output_type": "stream",
    "text": [
      "guardian\n",
      "0    52.69863\n",
      "1    45.62500\n",
      "Name: score, dtype: float64\n"
    ]
  }
],
"source": [
  "# Проверим, что изменилось\n",
  "grouped_guardian = stud_math.groupby(\n",
  "    ['guardian'])['score'].mean().sort_values(ascending=False)\n",
  "\n",
  "print(grouped_guardian)"
],
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "Используем эти данные."
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "# Traveltime "
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "время в пути до школы (1 - <15 мин., 2 - 15-30 мин., 3 - 30-60 мин., 4 - >60 мин.)"
  ]
},
{
  "cell_type": "code",
  "execution_count": 65,
  "metadata": {},
  "outputs": [
    {
      "data": {
        "text/html": [
          "<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",
"  <thead>\n",
"    <tr style=\"text-align: right;\">\n",
"      <th></th>\n",
"      <th>traveltime</th>\n",
"    </tr>\n",
"  </thead>\n",
"  <tbody>\n",
"    <tr>\n",
"      <th>1.0</th>\n",
"      <td>242</td>\n",
"    </tr>\n",
"    <tr>\n",
"      <th>2.0</th>\n",
"      <td>96</td>\n",
"    </tr>\n",
"    <tr>\n",
"      <th>3.0</th>\n",
"      <td>22</td>\n",
"    </tr>\n",
"    <tr>\n",
"      <th>4.0</th>\n",
"      <td>7</td>\n",
"    </tr>\n",
"  </tbody>\n",
"</table>\n",
"</div>"
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"      traveltime\n",
"1.0          242\n",
"2.0           96\n",
"3.0           22\n",
"4.0            7"
]
},
"metadata": {},
"output_type": "display_data"
},
{
"name": "stdout",
"output_type": "stream",

```

```

"text": [
  "Значений, встретившихся в столбце более 10 раз: 3\n",
  "<class 'pandas.core.frame.DataFrame'>\n",
  "RangeIndex: 395 entries, 0 to 394\n",
  "Data columns (total 1 columns):\n",
  " #   Column      Non-Null Count  Dtype  \n",
  "___  _\n",
  " 0   traveltime  367 non-null   float64\n",
  "dtypes: float64(1)\n",
  "memory usage: 3.2 KB\n"
]
},
],
"source": [
  "pd.DataFrame(stud_math.traveltime.value_counts())\n",
  "display(pd.DataFrame(stud_math.traveltime.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
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    пропуски значением, сколько ученики в среднем тратят на дорогу в  

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    "\n",
    "1. Проверим на наличие выбросов и при необходимости удалим их;\n",
    "\n",
    "2. Заменим пропуски средним значением."
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  "quant_25_TT = stud_math.traveltime.quantile(0.25)\n",
  "quant_75_TT = stud_math.traveltime.quantile(0.75)\n",
  "print('25-й перцентиль: {}, 75-й перцентиль: {}, IQR: {},\n",
  "Границы выбросов [{}, {}].'.format(\n",
  "    quant_25_TT, quant_75_TT, IQR_TT, quant_25_TT - 1.5*IQR_TT,\n",
  quant_75_TT + 1.5*IQR_TT))\n",
  "stud_math.traveltime.loc[stud_math.traveltime.between(\n",
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```

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        "memory usage: 3.2 KB\n"
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    "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
    "      (stud_math.traveltime.value_counts() > 10).sum())\n",
    "\n",
    "stud_math.loc[:, ['traveltime']].info()"
]
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```

```

    ]
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        "    }\n",
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```

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],
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  "pd.DataFrame(stud_math.traveltime.value_counts())\n",
  "display(pd.DataFrame(stud_math.traveltime.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
  "      (stud_math.traveltime.value_counts() > 10).sum())\n",
  "\n",
  "stud_math.loc[:, ['traveltime']].info()"
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    пропусков, это не значительно, в колонке числовые данные, допустимо  

    заменить пропуски значением, сколько ученики в среднем занимаются  

    вне школы. \n",
    "\n",
    "1. Проверим на наличие выбросов и при необходимости удалим их;  

\n",
    "2. Заменим пропуски средним значением."
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                    "        text-align: right;\n",
                    "    }\n",
                    "</style>\n",
                    "<table border='1' class='dataframe'>\n",
                    "    <thead>\n",
                    "        <tr style='text-align: right;'>\n",
                    "            <th></th>\n",
                    "            <th>studytime</th>\n",
                    "        </tr>\n",
                    "    </thead>\n",
                    "    <tbody>\n",
                    "        <tr>\n",
                    "            <th>2.0</th>\n",
                    "            <td>201</td>\n",
                    "        </tr>\n",
                    "        <tr>\n",
                    "            <th>1.0</th>\n",
                    "            <td>103</td>\n",
                    "        </tr>\n",
                    "        <tr>\n",
                    "            <th>3.0</th>\n",
                    "            <td>64</td>\n",
                    "        </tr>\n",
                    "        <tr>\n",
                    "            <th>4.0</th>\n",
                    "            <td>27</td>\n",
                    "        </tr>\n",
                    "    </tbody>\n",
                    "</table>\n",
                    "</div>"
                ]
            },
        ],
    ],

```

```

    "text/plain": [
      "      studytime\n",
      "2.0      201\n",
      "1.0      103\n",
      "3.0       64\n",
      "4.0       27"
    ]
  },
  "metadata": {},
  "output_type": "display_data"
},
{
  "name": "stdout",
  "output_type": "stream",
  "text": [
    "Значений, встретившихся в столбце более 10 раз: 4\n",
    "<class 'pandas.core.frame.DataFrame'>\n",
    "RangeIndex: 395 entries, 0 to 394\n",
    "Data columns (total 1 columns):\n",
    " #   Column      Non-Null Count  Dtype   \n",
    " ---  ---          -
    " 0   studytime  395 non-null    float64\n",
    "dtypes: float64(1)\n",
    "memory usage: 3.2 KB\n"
  ]
},
],
"source": [
  "# проверим\n",
  "pd.DataFrame(stud_math.studytime.value_counts())\n",
  "display(pd.DataFrame(stud_math.studytime.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
  "      (stud_math.studytime.value_counts() > 10).sum())\n",
  "\n",
  "stud_math.loc[:, ['studytime']].info()"
],
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "Мы видим, что более половины учеников тратят на занятия вне школы до 5 часов в неделю. Для простоты обработки приведем данные к двоичному значению 0 – до 5 часов, 1 – свыше 5."
  ]
},
{
  "cell_type": "code",
  "execution_count": 76,
  "metadata": {},
  "outputs": [],
  "source": [
    "stud_math.studytime = stud_math.studytime.apply(lambda x: 0 if x <= 2.0 else 1)"
  ]
}

```

```

    ]
  },
  {
    "cell_type": "code",
    "execution_count": 77,
    "metadata": {},
    "outputs": [
      {
        "name": "stdout",
        "output_type": "stream",
        "text": [
          "studytime\n",
          "1    57.333333\n",
          "0    50.735786\n",
          "Name: score, dtype: float64\n"
        ]
      }
    ],
    "source": [
      "# Теперь проверим влияет ли это на баллы учеников.\n",
      "grouped_studytime = stud_math.groupby(\n",
      "    ['studytime'])['score'].mean().sort_values(ascending=False)\n",
      "\n",
      "print(grouped_studytime)"
    ]
  },
  {
    "cell_type": "markdown",
    "metadata": {},
    "source": [
      "Мы видим, что ученики, которые тратят больше времени на занятия вне школы, имеют баллы на экзамене выше."
    ]
  },
  {
    "cell_type": "markdown",
    "metadata": {},
    "source": [
      "# Failures "
    ]
  },
  {
    "cell_type": "markdown",
    "metadata": {},
    "source": [
      "количество внеучебных неудач (n, если 1<=n<=3, иначе 0)"
    ]
  },
  {
    "cell_type": "code",
    "execution_count": 78,
    "metadata": {},
    "outputs": [

```

```

"data": {
  "text/html": [
    "<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",
    "  <thead>\n",
    "    <tr style=\"text-align: right;\">\n",
    "      <th></th>\n",
    "      <th>failures</th>\n",
    "    </tr>\n",
    "  </thead>\n",
    "  <tbody>\n",
    "    <tr>\n",
    "      <th>0.0</th>\n",
    "      <td>293</td>\n",
    "    </tr>\n",
    "    <tr>\n",
    "      <th>1.0</th>\n",
    "      <td>49</td>\n",
    "    </tr>\n",
    "    <tr>\n",
    "      <th>2.0</th>\n",
    "      <td>16</td>\n",
    "    </tr>\n",
    "    <tr>\n",
    "      <th>3.0</th>\n",
    "      <td>15</td>\n",
    "    </tr>\n",
    "  </tbody>\n",
    "</table>\n",
    "</div>"
  ],
  "text/plain": [
    "failures\n",
    "0.0      293\n",
    "1.0      49\n",
    "2.0      16\n",
    "3.0      15"
  ]
},
"metadata": {},
"output_type": "display_data"

```



```

},
{
  "name": "stdout",
  "output_type": "stream",
  "text": [
    "Значений, встретившихся в столбце более 10 раз: 4\n",
    "<class 'pandas.core.frame.DataFrame'>\n",
    "RangeIndex: 395 entries, 0 to 394\n",
    "Data columns (total 1 columns):\n",
    " #   Column      Non-Null Count  Dtype  \n",
    "___  _\n",
    " 0   failures  373 non-null    float64\n",
    "dtypes: float64(1)\n",
    "memory usage: 3.2 KB\n"
  ]
},
],
"source": [
  "pd.DataFrame(stud_math.failures.value_counts())\n",
  "display(pd.DataFrame(stud_math.failures.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
  "      (stud_math.failures.value_counts() > 10).sum())\n",
  "stud_math.loc[:, ['failures']].info()"
]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "Колонка содержит числовые данные, 395 строк, есть пропуски (22  

    пропуска, это значительно, в колонке числовые данные, допустимо  

    заменить пропуски средним или медиальным значением. В данной колонке  

    информация о кол-ве внеучебных неудач учеников. \n",
    "\n",
    "Заменим пропуски средним значением."
  ]
},
{
  "cell_type": "code",
  "execution_count": 79,
  "metadata": {},
  "outputs": [
    {
      "data": {
        "text/html": [
          "<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",
"    <thead>\n",
"        <tr style=\"text-align: right;\">\n",
"            <th></th>\n",
"            <th>failures</th>\n",
"        </tr>\n",
"    </thead>\n",
"    <tbody>\n",
"        <tr>\n",
"            <th>count</th>\n",
"            <td>373.000000</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>mean</th>\n",
"            <td>0.337802</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>std</th>\n",
"            <td>0.743135</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>min</th>\n",
"            <td>0.000000</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>25%</th>\n",
"            <td>0.000000</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>50%</th>\n",
"            <td>0.000000</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>75%</th>\n",
"            <td>0.000000</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>max</th>\n",
"            <td>3.000000</td>\n",
"        </tr>\n",
"    </tbody>\n",
"</table>\n",
"</div>"
],
"text/plain": [
"    failures\n",
"count  373.000000\n",
"mean    0.337802\n",
"std     0.743135\n",

```

```

        "min"      0.000000\n",
        "25%"     0.000000\n",
        "50%"     0.000000\n",
        "75%"     0.000000\n",
        "max"      3.000000"
    ]
},
"execution_count": 79,
"metadata": {},
"output_type": "execute_result"
}
],
"source": [
    "pd.DataFrame(stud_math.failures).describe()"
]
},
{
    "cell_type": "code",
    "execution_count": 80,
    "metadata": {},
    "outputs": [],
    "source": [
        "stud_math.loc[(stud_math['failures'].isnull()), 'failures'] =\nround(stud_math.failures.mean(), 0)"
    ]
},
{
    "cell_type": "code",
    "execution_count": 81,
    "metadata": {},
    "outputs": [
        {
            "data": {
                "text/html": [
                    "<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",
                    "  <thead>\n",
                    "    <tr style=\"text-align: right;\">\n",
                    "      <th></th>\n",
                    "      <th>failures</th>\n",
                    "    </tr>\n",

```

```

"    </thead>\n",
"    <tbody>\n",
"        <tr>\n",
"            <th>0.0</th>\n",
"            <td>315</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>1.0</th>\n",
"            <td>49</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>2.0</th>\n",
"            <td>16</td>\n",
"        </tr>\n",
"        <tr>\n",
"            <th>3.0</th>\n",
"            <td>15</td>\n",
"        </tr>\n",
"    </tbody>\n",
"</table>\n",
"</div>"
],
"text/plain": [
"    failures\n",
"0.0      315\n",
"1.0      49\n",
"2.0      16\n",
"3.0      15"
]
},
"metadata": {},
"output_type": "display_data"
},
{
"name": "stdout",
"output_type": "stream",
"text": [
"Значений, встретившихся в столбце более 10 раз: 4\n",
"<class 'pandas.core.frame.DataFrame'>\n",
"RangeIndex: 395 entries, 0 to 394\n",
"Data columns (total 1 columns):\n",
"#      Column      Non-Null Count  Dtype   \n",
"---  -\n",
"0    failures    395 non-null    float64\n",
"dtypes: float64(1)\n",
"memory usage: 3.2 KB\n"
]
}
],
"source": [
"# Проверим\n",
"pd.DataFrame(stud_math.failures.value_counts())\n",
"display(pd.DataFrame(stud_math.failures.value_counts()))\n",
"print(\"Значений, встретившихся в столбце более 10 раз:\",\n",

```

```

        (stud_math.failures.value_counts() > 10).sum())\n",
        "stud_math.loc[:, ['failures']].info()"
    ]
},
{
    "cell_type": "code",
    "execution_count": 82,
    "metadata": {},
    "outputs": [
        {
            "name": "stdout",
            "output_type": "stream",
            "text": [
                "failures\n",
                "0.0    56.121795\n",
                "1.0    40.000000\n",
                "2.0    32.333333\n",
                "3.0    29.642857\n",
                "Name: score, dtype: float64\n"
            ]
        }
    ],
    "source": [
        "# Теперь проверим влияет ли это на баллы учеников.\n",
        "grouped_failures = stud_math.groupby(\n",
        "    ['failures'])['score'].mean().sort_values(ascending=False)\n",
        "\n",
        "print(grouped_failures)"
    ]
},
{
    "cell_type": "markdown",
    "metadata": {},
    "source": [
        "Данные показатель имеет значение, используем его."
    ]
},
{
    "cell_type": "markdown",
    "metadata": {},
    "source": [
        "# Schoolsup"
    ]
},
{
    "cell_type": "markdown",
    "metadata": {},
    "source": [
        "дополнительная образовательная поддержка (yes или no)"
    ]
},
{
    "cell_type": "code",
    "execution_count": 83,

```

```

"metadata": {},
"outputs": [
  {
    "data": {
      "text/html": [
        "<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",
        "  <thead>\n",
        "    <tr style='text-align: right;'>\n",
        "      <th></th>\n",
        "      <th>schoolsup</th>\n",
        "    </tr>\n",
        "  </thead>\n",
        "  <tbody>\n",
        "    <tr>\n",
        "      <th>0.0</th>\n",
        "      <td>335</td>\n",
        "    </tr>\n",
        "    <tr>\n",
        "      <th>1.0</th>\n",
        "      <td>51</td>\n",
        "    </tr>\n",
        "  </tbody>\n",
        "</table>\n",
        "</div>"
      ],
      "text/plain": [
        "    schoolsup\n",
        "0.0      335\n",
        "1.0       51"
      ]
    },
    "metadata": {},
    "output_type": "display_data"
  },
  {
    "name": "stdout",
    "output_type": "stream",
    "text": [
      "Значений, встретившихся в столбце более 10 раз: 2\n",
      "<class 'pandas.core.frame.DataFrame'>\n",

```

```

    "RangeIndex: 395 entries, 0 to 394\n",
    "Data columns (total 1 columns):\n",
    " #   Column      Non-Null Count  Dtype   \n",
    " ---  ---          -
    " 0   schoolsup  386 non-null    float64\n",
    "dtypes: float64(1)\n",
    "memory usage: 3.2 KB\n"
  ]
},
],
"source": [
  "pd.DataFrame(stud_math.schoolsup.value_counts())\n",
  "display(pd.DataFrame(stud_math.schoolsup.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
  "      (stud_math.schoolsup.value_counts() > 10).sum())\n",
  "stud_math.loc[:, ['schoolsup']].info()"
]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "Колонка содержит числовые данные, 395 строк, есть пропуски. В данной колонке информация о наличии дополнительной образовательной поддержка (yes или no). Пропуски мы заполнять не будем, так как нет необходимой информации."
  ]
},
{
  "cell_type": "code",
  "execution_count": 84,
  "metadata": {},
  "outputs": [
    {
      "name": "stdout",
      "output_type": "stream",
      "text": [
        "schoolsup\n",
        "0.0    53.126888\n",
        "1.0    47.040816\n",
        "Name: score, dtype: float64\n"
      ]
    }
  ],
  "source": [
    "# Теперь проверим влияет ли это на баллы учеников.\n",
    "grouped_schoolsup = stud_math.groupby(\n",
    "    ['schoolsup'])['score'].mean().sort_values(ascending=False)\n",
    "\n",
    "print(grouped_schoolsup)"
  ]
},
{
  "cell_type": "markdown",

```

```

"metadata": {},
"source": [
  "Влияет на уровень подготовки учеников к экзамену."
]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "# Famsup "
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "семейная образовательная поддержка (yes или no)"
  ]
},
{
  "cell_type": "code",
  "execution_count": 85,
  "metadata": {},
  "outputs": [
    {
      "data": {
        "text/html": [
          "<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",
          "  <thead>\n",
          "    <tr style=\"text-align: right;\">\n",
          "      <th></th>\n",
          "      <th>famsup</th>\n",
          "    </tr>\n",
          "  </thead>\n",
          "  <tbody>\n",
          "    <tr>\n",
          "      <th>1.0</th>\n",
          "      <td>219</td>\n",
          "    </tr>\n",
          "    <tr>\n",

```



```

        <th>0.0</th>\n",
        <td>137</td>\n",
        </tr>\n",
        </tbody>\n",
    "</table>\n",
    "</div>"
],
"text/plain": [
    "    famsup\n",
    "1.0      219\n",
    "0.0      137"
]
},
"metadata": {},
"output_type": "display_data"
},
{
    "name": "stdout",
    "output_type": "stream",
    "text": [
        "Значений, встретившихся в столбце более 10 раз: 2\n",
        "<class 'pandas.core.frame.DataFrame'>\n",
        "RangeIndex: 395 entries, 0 to 394\n",
        "Data columns (total 1 columns):\n",
        "#    Column  Non-Null Count  Dtype  \n",
        "---  -
        0    famsup    356 non-null    float64\n",
        "dtypes: float64(1)\n",
        "memory usage: 3.2 KB\n"
    ]
},
],
"source": [
    "pd.DataFrame(stud_math.famsup.value_counts())\n",
    "display(pd.DataFrame(stud_math.famsup.value_counts()))\n",
    "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
    "      (stud_math.famsup.value_counts() > 10).sum())\n",
    "stud_math.loc[:, ['famsup']].info()"
]
},
{
    "cell_type": "markdown",
    "metadata": {},
    "source": [
        "Колонка содержит числовые данные, 395 строк, есть пропуски. В данной колонке информация о наличии семейная образовательная поддержка (yes или no). Пропуски мы заполнять не будем, так как нет необходимой информации."
    ]
},
{
    "cell_type": "code",
    "execution_count": 86,
    "metadata": {},

```

```

"outputs": [
  {
    "name": "stdout",
    "output_type": "stream",
    "text": [
      "famsup\n",
      "0.0    52.074074\n",
      "1.0    51.712963\n",
      "Name: score, dtype: float64\n"
    ]
  }
],
"source": [
  "# Теперь проверим влияет ли это на баллы учеников.\n",
  "grouped_famsup= stud_math.groupby(\n",
  "    ['famsup'])['score'].mean().sort_values(ascending=False)\n",
  "\n",
  "print(grouped_famsup)"
],
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "Практически не влияет."
  ]
},
{
  "cell_type": "code",
  "execution_count": 134,
  "metadata": {},
  "outputs": [],
  "source": [
    "stud_math.drop(['famsup'], inplace = True, axis = 1)"
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "# Paid "
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "дополнительные платные занятия по математике (yes или no)"
  ]
},
{
  "cell_type": "code",
  "execution_count": 87,
  "metadata": {},

```

```

"outputs": [
{
  "data": {
    "text/html": [
      "<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",
      "  <thead>\n",
      "    <tr style='text-align: right;'>\n",
      "      <th></th>\n",
      "      <th>paid</th>\n",
      "    </tr>\n",
      "  </thead>\n",
      "  <tbody>\n",
      "    <tr>\n",
      "      <th>0.0</th>\n",
      "      <td>200</td>\n",
      "    </tr>\n",
      "    <tr>\n",
      "      <th>1.0</th>\n",
      "      <td>155</td>\n",
      "    </tr>\n",
      "  </tbody>\n",
      "</table>\n",
      "</div>"
    ],
    "text/plain": [
      "   paid\n",
      "0.0   200\n",
      "1.0   155"
    ]
  },
  "metadata": {},
  "output_type": "display_data"
},
{
  "name": "stdout",
  "output_type": "stream",
  "text": [
    "Значений, встретившихся в столбце более 10 раз: 2\n",
    "<class 'pandas.core.frame.DataFrame'>\n",
    "RangeIndex: 395 entries, 0 to 394\n",

```

```

    "Data columns (total 1 columns):\n",
    " #   Column   Non-Null Count  Dtype   \n",
    "----  -\n",
    "  0   paid     355 non-null    float64\n",
    "dtypes: float64(1)\n",
    "memory usage: 3.2 KB\n"
  ]
}
],
"source": [
  "pd.DataFrame(stud_math.paid.value_counts())\n",
  "display(pd.DataFrame(stud_math.paid.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
  "      (stud_math.paid.value_counts() > 10).sum())\n",
  "stud_math.loc[:, ['paid']].info()"
]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "Колонка содержит числовые данные, 395 строк, есть пропуски. В данной колонке информация о наличии дополнительных платных занятий по математике (yes или no). Пропуски мы заполнять не будем, так как нет необходимой информации."
  ]
},
{
  "cell_type": "code",
  "execution_count": 88,
  "metadata": {},
  "outputs": [
    {
      "name": "stdout",
      "output_type": "stream",
      "text": [
        "paid\n",
        "1.0     55.00000\n",
        "0.0     50.35533\n",
        "Name: score, dtype: float64\n"
      ]
    }
  ],
  "source": [
    "# Теперь проверим влияет ли это на баллы учеников.\n",
    "grouped_paid= stud_math.groupby(\n",
    "    ['paid'])['score'].mean().sort_values(ascending=False)\n",
    "print(grouped_paid)"
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [

```

"Влияет на уровень подготовки учеников. Используем этот параметр."

```
]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "# Activities"
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "дополнительные внеучебные занятия (yes или no)"
  ]
},
{
  "cell_type": "code",
  "execution_count": 89,
  "metadata": {},
  "outputs": [
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      "data": {
        "text/html": [
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          "<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",
          "  <thead>\n",
          "    <tr style='text-align: right;'>\n",
          "      <th></th>\n",
          "      <th>activities</th>\n",
          "    </tr>\n",
          "  </thead>\n",
          "  <tbody>\n",
          "    <tr>\n",
          "      <th>1.0</th>\n",
          "      <td>195</td>\n",
          "    </tr>\n",
          "    <tr>\n",
          "      <th>0.0</th>
```

```

        <td>186</td>\n",
        </tr>\n",
    </tbody>\n",
</table>\n",
</div>
],
"text/plain": [
    activities\n",
    1.0      195\n",
    0.0      186"
]
},
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},
{
    "name": "stdout",
    "output_type": "stream",
    "text": [
        "Значений, встретившихся в столбце более 10 раз: 2\n",
        "<class 'pandas.core.frame.DataFrame'>\n",
        "RangeIndex: 395 entries, 0 to 394\n",
        "Data columns (total 1 columns):\n",
        "#      Column      Non-Null Count  Dtype  \n",
        "---  -
        0      activities  381 non-null    float64\n",
        "dtypes: float64(1)\n",
        "memory usage: 3.2 KB\n"
    ]
}
],
"source": [
    "pd.DataFrame(stud_math.activities.value_counts())\n",
    "display(pd.DataFrame(stud_math.activities.value_counts()))\n",
    "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
    "      (stud_math.activities.value_counts() > 10).sum())\n",
    "stud_math.loc[:, ['activities']].info()"
]
},
{
    "cell_type": "markdown",
    "metadata": {},
    "source": [
        "Колонка содержит числовые данные, 395 строк, есть пропуски. В данной колонке информация о том, были ли дополнительные внеучебные занятия (yes или no). Пропуски мы заполнять не будем, так как нет необходимой информации."
    ]
}
],
{
    "cell_type": "code",
    "execution_count": 90,
    "metadata": {},
    "outputs": [

```

```

{
  "name": "stdout",
  "output_type": "stream",
  "text": [
    "activities\n",
    "1.0    52.682292\n",
    "0.0    52.185792\n",
    "Name: score, dtype: float64\n"
  ]
},
{
  "source": [
    "# Теперь проверим влияет ли это на баллы учеников.\n",
    "grouped_activities= stud_math.groupby(\n",
    "    ['activities'])\n",
    "['score'].mean().sort_values(ascending=False)\n",
    "print(grouped_activities)"
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "Практически не влияет."
  ]
},
{
  "cell_type": "code",
  "execution_count": 135,
  "metadata": {},
  "outputs": [],
  "source": [
    "stud_math.drop(['activities'], inplace = True, axis = 1)"
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "# Nursery"
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "посещал детский сад (yes или no)"
  ]
},
{
  "cell_type": "code",
  "execution_count": 91,
  "metadata": {},
  "outputs": [

```

```

{
  "data": {
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      "    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",
      "  <thead>\n",
      "    <tr style='text-align: right;'>\n",
      "      <th></th>\n",
      "      <th>nursery</th>\n",
      "    </tr>\n",
      "  </thead>\n",
      "  <tbody>\n",
      "    <tr>\n",
      "      <th>1.0</th>\n",
      "      <td>300</td>\n",
      "    </tr>\n",
      "    <tr>\n",
      "      <th>0.0</th>\n",
      "      <td>79</td>\n",
      "    </tr>\n",
      "  </tbody>\n",
      "</table>\n",
      "</div>"
    ],
    "text/plain": [
      "nursery\n",
      "1.0      300\n",
      "0.0      79"
    ]
  },
  "metadata": {},
  "output_type": "display_data"
},
{
  "name": "stdout",
  "output_type": "stream",
  "text": [
    "Значений, встретившихся в столбце более 10 раз: 2\n",
    "<class 'pandas.core.frame.DataFrame'>\n",
    "RangeIndex: 395 entries, 0 to 394\n",
    "Data columns (total 1 columns):\n"
  ]
}

```



```

" #      Column      Non-Null Count  Dtype  \n",
"----  -
" 0      nursery    379 non-null    float64\n",
"dtypes: float64(1)\n",
"memory usage: 3.2 KB\n"
]
}
],
"source": [
"pd.DataFrame(stud_math.nursery.value_counts())\n",
"display(pd.DataFrame(stud_math.nursery.value_counts()))\n",
"print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
"      (stud_math.nursery.value_counts() > 10).sum())\n",
"stud_math.loc[:, ['nursery']].info()"
]
},
{
"cell_type": "markdown",
"metadata": {},
"source": [
"Колонка содержит числовые данные, 395 строк, есть пропуски. В
данной колонке информация о том, посещал ли ученик детский сад (yes
или no). Пропуски мы заполнять не будем, так как нет необходимой
информации."
]
},
{
"cell_type": "code",
"execution_count": 92,
"metadata": {},
"outputs": [
{
"name": "stdout",
"output_type": "stream",
"text": [
"nursery\n",
"1.0      52.962963\n",
"0.0      50.000000\n",
"Name: score, dtype: float64\n"
]
}
],
"source": [
"# Теперь проверим влияет ли это на баллы учеников.\n",
"grouped_nursery= stud_math.groupby(\n",
"    ['nursery'])['score'].mean().sort_values(ascending=False)
\n",
"print(grouped_nursery)"
]
},
{
"cell_type": "markdown",
"metadata": {},
"source": [

```

```

"Влияет, но не значительно. При этом используем эти данные."
]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "# Studytime_granular"
  ]
},
{
  "cell_type": "code",
  "execution_count": 93,
  "metadata": {},
  "outputs": [
    {
      "data": {
        "text/html": [
          "<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",
          "  <thead>\n",
          "    <tr style=\"text-align: right;\">\n",
          "      <th></th>\n",
          "      <th>studytime_granular</th>\n",
          "    </tr>\n",
          "  </thead>\n",
          "  <tbody>\n",
          "    <tr>\n",
          "      <th>-6.0</th>\n",
          "      <td>194</td>\n",
          "    </tr>\n",
          "    <tr>\n",
          "      <th>-3.0</th>\n",
          "      <td>103</td>\n",
          "    </tr>\n",
          "    <tr>\n",
          "      <th>-9.0</th>\n",
          "      <td>64</td>\n",
          "    </tr>\n",
          "    <tr>\n",
          "      <th>-12.0</th>\n
```

```

        <td>27</td>\n",
        </tr>\n",
    </tbody>\n",
</table>\n",
</div>
],
"text/plain": [
    studytime_granular\n",
    -6.0      194\n",
    -3.0      103\n",
    -9.0       64\n",
    -12.0      27"
]
},
"metadata": {},
"output_type": "display_data"
},
{
    "name": "stdout",
    "output_type": "stream",
    "text": [
        "Значений, встретившихся в столбце более 10 раз: 4\n",
        "<class 'pandas.core.frame.DataFrame'>\n",
        "RangeIndex: 395 entries, 0 to 394\n",
        "Data columns (total 1 columns):\n",
        " #   Column                Non-Null Count  Dtype  \n",
        "___  _\n",
        " 0   studytime_granular    388 non-null   float64\n",
        "dtypes: float64(1)\n",
        "memory usage: 3.2 KB\n"
    ]
}
],
"source": [
    "pd.DataFrame(stud_math.studytime_granular.value_counts())\n",
    "display(pd.DataFrame(stud_math.studytime_granular.value_counts()))\n",
    "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
    "      (stud_math.studytime_granular.value_counts() > 10).sum())\n",
    "stud_math.loc[:, ['studytime_granular']].info()"
]
},
{
    "cell_type": "markdown",
    "metadata": {},
    "source": [
        "Колонка имеет цифровые значения, отрицательные значения. Имеет пропуски (7), но это не значительно. У нас нет информации о том какие данные отображает данная колонка. Посмотрим как она коррелируется с другими данными."
    ]
}
],

```

```

{
  "cell_type": "code",
  "execution_count": 94,
  "metadata": {},
  "outputs": [
    {
      "data": {
        "text/plain": [
          "<AxesSubplot:>"
        ]
      },
      "execution_count": 94,
      "metadata": {},
      "output_type": "execute_result"
    },
    {
      "data": {
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```

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+f0Tm5lb7qfE4rhppE8gH4c14S6VjD140YT5+I8YfgOMTVzLF/
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```

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}
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    "sns.heatmap(stud_math.corr())"
]
},
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    "metadata": {},
    "source": [
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        "studytime_granular. \n",
        "\n",
        "Не будем использовать эти данные, удалим колонку."
    ]
},
{
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    "execution_count": 95,
    "metadata": {},
    "outputs": [],
    "source": [
        "stud_math.drop(['studytime_granular'], inplace = True, axis =
1)"
    ]
},
{
    "cell_type": "code",
    "execution_count": 96,
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    "outputs": [],
    "source": [
        "stud_math.head()"
    ]
}

```

```

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"metadata": {},
"source": [
    "# Higher"
]
},
{
"cell_type": "markdown",
"metadata": {},
"source": [
    "хочет получить высшее образование (yes или no)"
]
},
{
"cell_type": "code",
"execution_count": 96,
"metadata": {},
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                "<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",
                "  <thead>\n",
                "    <tr style='text-align: right;'>\n",
                "      <th></th>\n",
                "      <th>higher</th>\n",
                "    </tr>\n",
                "  </thead>\n",
                "  <tbody>\n",
                "    <tr>\n",
                "      <th>1.0</th>\n",
                "      <td>356</td>\n",
                "    </tr>\n",
                "    <tr>\n",
                "      <th>0.0</th>\n",
                "      <td>19</td>\n",
                "    </tr>\n",
                "  </tbody>\n",
                "</table>\n",
                "</div>"
            ]
        }
    ]
}

```

```

],
"text/plain": [
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  "1.0      356\n",
  "0.0      19"
]
},
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},
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  "output_type": "stream",
  "text": [
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    "<class 'pandas.core.frame.DataFrame'>\n",
    "RangeIndex: 395 entries, 0 to 394\n",
    "Data columns (total 1 columns):\n",
    " #   Column  Non-Null Count  Dtype  \n",
    "___  _\n",
    " 0   higher  375 non-null      float64\n",
    "dtypes: float64(1)\n",
    "memory usage: 3.2 KB\n"
  ]
}
],
"source": [
  "pd.DataFrame(stud_math.higher.value_counts())\n",
  "display(pd.DataFrame(stud_math.higher.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
  "      (stud_math.higher.value_counts() > 10).sum())\n",
  "stud_math.loc[:, ['higher']].info()"
]
},
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  "metadata": {},
  "source": [
    "Колонка содержит числовые данные, 395 строк, есть пропуски. В данной колонке информация о том, собирается ли далее ученик поступать в высшее учебное заведение (yes или no). Пропуски мы заполнять не будем, так как нет необходимой информации."
  ]
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{
  "cell_type": "code",
  "execution_count": 97,
  "metadata": {},
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    {
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      "output_type": "stream",
      "text": [
        "higher\n",

```

```

"1.0      53.100000\n",
"0.0      33.684211\n",
"Name: score, dtype: float64\n"
]
}
],
"source": [
"# Теперь проверим влияет ли это на баллы учеников.\n",
"grouped_higher= stud_math.groupby(\n",
"    ['higher'])['score'].mean().sort_values(ascending=False)\n",
"print(grouped_higher)"
]
},
{
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"Данный показатель значительно влияет на предсказываемую величину. Используем этот параметр."
]
},
{
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"metadata": {},
"source": [
"# Internet "
]
},
{
"cell_type": "markdown",
"metadata": {},
"source": [
"наличие интернета дома (yes или no)"
]
},
{
"cell_type": "code",
"execution_count": 98,
"metadata": {},
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{
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"<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",
    "  <thead>\n",
    "    <tr style=\"text-align: right;\">\n",
    "      <th></th>\n",
    "      <th>internet</th>\n",
    "    </tr>\n",
    "  </thead>\n",
    "  <tbody>\n",
    "    <tr>\n",
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    "    </tr>\n",
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    "      <th>0.0</th>\n",
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    "    </tr>\n",
    "  </tbody>\n",
    "</table>\n",
    "</div>"
  ],
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    "1.0      305\n",
    "0.0       56"
  ]
},
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},
{
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    "RangeIndex: 395 entries, 0 to 394\n",
    "Data columns (total 1 columns):\n",
    "#      Column      Non-Null Count  Dtype   \n",
    "---  -\n",
    "0     internet  361 non-null    float64\n",
    "dtypes: float64(1)\n",
    "memory usage: 3.2 KB"
  ]
}
],
"source": [
  "pd.DataFrame(stud_math.internet.value_counts())\n",
  "display(pd.DataFrame(stud_math.internet.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
  "      (stud_math.internet.value_counts() > 10).sum())\n",

```

```

    "stud_math.loc[:, ['internet']].info()"
  ]
},
{
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  "metadata": {},
  "source": [
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данной колонке информация о том, есть ли дома у ученика интернет
(yes или no). Пропуски мы заполнять не будем, так как нет
необходимой информации."
  ]
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        "0.0    49.090909\n",
        "Name: score, dtype: float64\n"
      ]
    }
  ],
  "source": [
    "# Теперь проверим влияет ли это на баллы учеников.\n",
    "grouped_internet= stud_math.groupby(\n",
    "    ['internet'])['score'].mean().sort_values(ascending=False)
\n",
    "print(grouped_internet)"
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "Влияет, но не значительно. При этом используем эти данные."
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},
  "source": [
    "# Romantic"
  ]
},
{
  "cell_type": "markdown",
  "metadata": {},

```

```

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  "в романтических отношениях (yes или no)"
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},
{
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          "    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",
          "  <thead>\n",
          "    <tr style=\"text-align: right;\">\n",
          "      <th></th>\n",
          "      <th>romantic</th>\n",
          "    </tr>\n",
          "  </thead>\n",
          "  <tbody>\n",
          "    <tr>\n",
          "      <th>0.0</th>\n",
          "      <td>240</td>\n",
          "    </tr>\n",
          "    <tr>\n",
          "      <th>1.0</th>\n",
          "      <td>124</td>\n",
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          "</table>\n",
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          "1.0      124"
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},

```

```

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    "RangeIndex: 395 entries, 0 to 394\n",
    "Data columns (total 1 columns):\n",
    " #   Column      Non-Null Count  Dtype  \n",
    "___  _\n",
    " 0   romantic  364 non-null    float64\n",
    "dtypes: float64(1)\n",
    "memory usage: 3.2 KB\n"
  ]
},
],
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  "display(pd.DataFrame(stud_math.romantic.value_counts()))\n",
  "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
  "      (stud_math.romantic.value_counts() > 10).sum())\n",
  "stud_math.loc[:, ['romantic']].info()"
]
},
{
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  "metadata": {},
  "source": [
    "Колонка содержит числовые данные, 395 строк, есть пропуски. В данной колонке информация о том, состоит ли ученик в в романтических отношениях (yes или no). Пропуски мы заполнять не будем, так как нет необходимой информации."
  ]
},
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        "1.0    47.682927\n",
        "Name: score, dtype: float64\n"
      ]
    }
  ],
  "source": [
    "# Теперь проверим влияет ли это на баллы учеников.\n",
    "grouped_romantic= stud_math.groupby(\n"
  ]

```



```

    ["romantic"]['score'].mean().sort_values(ascending=False)
\n",
    "print(grouped_romantic)"
  ],
  {
    "cell_type": "markdown",
    "metadata": {},
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    ]
  },
  {
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    ]
  },
  {
    "cell_type": "markdown",
    "metadata": {},
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            "    }\n",
            "\n",
            "    .dataframe tbody tr th {\n",
            "        vertical-align: top;\n",
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            "    .dataframe thead th {\n",
            "        text-align: right;\n",
            "    }\n",
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            "      <th>famrel</th>\n",
            "    </tr>\n",

```

```

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"</table>\n",
"</div>"
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" 4.0    182\n",
" 5.0     99\n",
" 3.0     62\n",
" 2.0     17\n",
" 1.0      7\n",
"-1.0      1"
]
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"Data columns (total 1 columns):\n",
" #   Column  Non-Null Count  Dtype  \n",
"---  -
" 0   famrel  368 non-null    float64\n",

```

```

        "dtypes: float64(1)\n",
        "memory usage: 3.2 KB\n"
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}
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    "display(pd.DataFrame(stud_math.famrel.value_counts()))\n",
    "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
    "      (stud_math.famrel.value_counts() > 10).sum())\n",
    "stud_math.loc[:, ['famrel']].info()"
]
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        "Колонка содержит числовые данные, 395 строк, есть пропуски (27 пропусков, это значительно), в колонке числовые данные, допустимо заменить пропуски средним значением. \n",
        "\n",
        "1. Проверим на наличие выбросов и при необходимости удалим их;\n",
        "2. Заменим пропуски средним значением."
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            ]
        }
    ],
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[illegible]

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    "    0.75) - stud_math.traveltime.quantile(0.25)\n",
    "quant_25_famrel = stud_math.famrel.quantile(0.25)\n",
    "quant_75_famrel = stud_math.famrel.quantile(0.75)\n",
    "print('25-й перцентиль: {}, 75-й перцентиль: {}, IQR: {},\n",
    "Границы выбросов [{}, {}]'.format(\n",
    "    quant_25_famrel, quant_75_famrel, IQR_famrel,\n",
    "    quant_25_famrel - 1.5*IQR_famrel, quant_75_famrel + 1.5*IQR_famrel))\n",
    "stud_math.famrel.loc[stud_math.famrel.between(\n",
    "    quant_25_famrel - 1.5*IQR_famrel, quant_75_famrel +\n",
    "    1.5*IQR_famrel)].hist(bins=5, range=(-1, 5))\n",
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      "Выбросов нет, но есть аномальное значение -1, заменим его на 1\n",
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```

```

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                    "1.0    53.125000\n",
                    "4.0    51.536585\n",
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                    "2.0    48.529412\n",
                    "Name: score, dtype: float64\n"
                ]
            }
        ],
        "source": [
            "# Оценим средние значения об успеваемости в зависимости от
отношений в семье ученика.\n",
            "grouped_famrel = stud_math.groupby(\n",
            "    ['famrel'])['score'].mean().sort_values(ascending=False)
\n",
            "print(grouped_famrel)"
        ]
    },
    {
        "cell_type": "markdown",
        "metadata": {},
        "source": [
            "Мы видим, что в среднем уровень отношений в семье не влияет на
успеваемость учеников. Не будем использовать этот параметр."
        ]
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    }

```

```

]
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  ]
},
{
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    много)"
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          "    }\n",
          "    .dataframe tbody tr th {\n",
          "        vertical-align: top;\n",
          "    }\n",
          "    .dataframe thead th {\n",
          "        text-align: right;\n",
          "    }\n",
          "</style>\n",
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          "      <th></th>\n",
          "      <th>freetime</th>\n",
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```



```

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"4.0    112\n",
"2.0     63\n",
"5.0     38\n",
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"Data columns (total 1 columns):\n",
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"___  _\n",
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"dtypes: float64(1)\n",
"memory usage: 3.2 KB\n"
]
}
],
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"display(pd.DataFrame(stud_math.freetime.value_counts()))\n",
"print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
"      (stud_math.freetime.value_counts() > 10).sum())\n",
"stud_math.loc[:, ['freetime']].info()"
]
},
{

```

```

"cell_type": "markdown",
"metadata": {},
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    "Колонка содержит числовые данные, 395 строк, есть пропуски (11
    пропуска, значительно), в колонке числовые данные, допустимо
    заменить пропуски средним значением. "
]

```

```

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                    "    .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",
                    "  <thead>\n",
                    "    <tr style=\"text-align: right;\">\n",
                    "      <th></th>\n",
                    "      <th>freetime</th>\n",
                    "    </tr>\n",
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                    "  <tbody>\n",
                    "    <tr>\n",
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                    "      <td>384.000000</td>\n",
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                    "      <th>std</th>\n",
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```

```

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"    </tr>\n",
"    <tr>\n",
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"</table>\n",
"</div>"
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"mean      3.231771\n",
"std       0.993940\n",
"min       1.000000\n",
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"50%       3.000000\n",
"75%       4.000000\n",
"max       5.000000"
]
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"metadata": {},
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}
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"5.0    56.351351\n",
"4.0    52.636364\n",

```

```

        "3.0    48.947368\n",
        "1.0    48.333333\n",
        "Name: score, dtype: float64\n"
    ]
}
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"source": [
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свободного времени ученика.\n",
    "grouped_freetime = stud_math.groupby(\n",
    "    ['freetime'])['score'].mean().sort_values(ascending=False)
\n",
    "print(grouped_freetime)"
]
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    "metadata": {},
    "source": [
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свободного времени, можно предположить, что данный показатель не
влияет на прогнозируемый показатель. Не будем его использовать."
    ]
},
{
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},
{
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много)"
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    "\n",
    "  .dataframe thead th {\n",
    "    text-align: right;\n",
    "  }\n",
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}

```

```

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        "#      Column  Non-Null Count  Dtype  \n",
        "---  -
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        "dtypes: float64(1)\n",
        "memory usage: 3.2 KB\n"
    ]
}
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    "display(pd.DataFrame(stud_math.go_out.value_counts()))\n",
    "print(\"Значений, встретившихся в столбце более 10 раз:\",\n",
    "      (stud_math.go_out.value_counts() > 10).sum())\n",
    "stud_math.loc[:, ['go_out']].info()"
]
},
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    "source": [
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    ]
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```

```

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"\n",
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"count  387.000000\n",

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```

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                "1.0    49.347826\n",
                "5.0    44.509804\n",
                "Name: score, dtype: float64\n"
            ]
        }
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        "# Оценим средние значения об успеваемости в зависимости от  

        времени проведенного учеником с друзьями.\n",
        "grouped_go_out = stud_math.groupby(\n",
        "    ['go_out'])['score'].mean().sort_values(ascending=False)\n",
        "\n",
        "print(grouped_go_out)"
    ]
},
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        "Так же как и по показателю Freetime, по разбросу среднего балла  

        у учеников, можно предположить, что данный показатель не влияет на  

        прогнозируемый показатель. Не будем его использовать."
    ]
}

```



```

},
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"#      Column  Non-Null Count  Dtype   \n",
"---  -\n",
"0    health    380 non-null    float64\n",
"dtypes: float64(1)\n",
"memory usage: 3.2 KB\n"
]
}
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"source": [

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```

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"display(pd.DataFrame(stud_math.health.value_counts()))\n",
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"stud_math.loc[:, ['health']].info()"
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"Проверим есть ли выбросы."
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Границы выбросов [{}, {}].'.format(\n",  
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  \n",  
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выше чем, ученики без пропусков. Не логично, конечно, но как есть.  
Данна существенно различаются, используем их."
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        "В колонке данные содержащие наш прогнозируемый параметр – результаты экзаменов по 100 балльной шкале. Проверим его на наличие выбросов."
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      "        <= 0.05/len(combinations_all): # Учли поправку\n",
      "Бонферони\n",
      "            print('Найдены статистически значимые различия для\n",
      "колонки', column)\n",
      "            break"
    ]
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        "name": "stdout",
        "output_type": "stream",

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```

    "text": [
        "Найдены статистически значимые различия для колонки Mjob\n"
    ]
},
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    "for col in ['Mjob', 'Fjob']:\n",
    "    get_stat_dif(col)"
],
{
    "cell_type": "markdown",
    "metadata": {},
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        "Как мы видим, серьёзно отличается значения для колонки Mjob."
    ]
},
{
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    "source": [
        "Итак, в нашем случае важные переменные, которые, возможно,
        оказывают влияние на оценку, это: 'age', 'Medu', 'Mjob', 'Fjob',
        'guardian', 'studytime',\n",
        "        'failures', 'schoolsup', 'paid', 'nursery', 'higher',
        'internet',\n",
        "        'romantic', 'absences', 'score'."
    ]
},
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                    "        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",
                    "  <thead>\n",
                    "    <tr style='text-align: right;'>\n",

```

```

"      <th></th>\n",
"      <th>age</th>\n",
"      <th>Medu</th>\n",
"      <th>Mjob</th>\n",
"      <th>Fjob</th>\n",
"      <th>guardian</th>\n",
"      <th>studytime</th>\n",
"      <th>failures</th>\n",
"      <th>schoolsup</th>\n",
"      <th>paid</th>\n",
"      <th>nursery</th>\n",
"      <th>higher</th>\n",
"      <th>internet</th>\n",
"      <th>romantic</th>\n",
"      <th>absences</th>\n",
"      <th>score</th>\n",
"    </tr>\n",
"  </thead>\n",
"  <tbody>\n",
"    <tr>\n",
"      <th>0</th>\n",
"      <td>18</td>\n",
"      <td>4.0</td>\n",
"      <td>at_home</td>\n",
"      <td>teacher</td>\n",
"      <td>0</td>\n",
"      <td>0</td>\n",
"      <td>0.0</td>\n",
"      <td>1.0</td>\n",
"      <td>0.0</td>\n",
"      <td>1.0</td>\n",
"      <td>1.0</td>\n",
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"      <td>0.0</td>\n",
"      <td>1</td>\n",
"      <td>30.0</td>\n",
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"    <tr>\n",
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"      <td>1.0</td>\n",
"      <td>at_home</td>\n",
"      <td>other</td>\n",
"      <td>0</td>\n",
"      <td>0</td>\n",
"      <td>0.0</td>\n",
"      <td>0.0</td>\n",
"      <td>0.0</td>\n",
"      <td>0.0</td>\n",
"      <td>1.0</td>\n",
"      <td>1.0</td>\n",
"      <td>0.0</td>\n",
"      <td>1</td>\n",
"      <td>30.0</td>\n",

```

```

"    </tr>\n",
"    <tr>\n",
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"        <td>other</td>\n",
"        <td>0</td>\n",
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"        <td>1.0</td>\n",
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"    <tr>\n",
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"        <td>15</td>\n",
"        <td>4.0</td>\n",
"        <td>health</td>\n",
"        <td>other</td>\n",
"        <td>0</td>\n",
"        <td>1</td>\n",
"        <td>0.0</td>\n",
"        <td>0.0</td>\n",
"        <td>1.0</td>\n",
"        <td>1.0</td>\n",
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"    <tr>\n",
"        <th>4</th>\n",
"        <td>16</td>\n",
"        <td>3.0</td>\n",
"        <td>other</td>\n",
"        <td>other</td>\n",
"        <td>0</td>\n",
"        <td>0</td>\n",
"        <td>0.0</td>\n",
"        <td>0.0</td>\n",
"        <td>1.0</td>\n",
"        <td>1.0</td>\n",
"        <td>1.0</td>\n",
"        <td>0.0</td>\n",
"        <td>0.0</td>\n",
"        <td>1</td>\n",
"        <td>50.0</td>\n",

```

```

"      </tr>\n",
"    </tbody>\n",
"</table>\n",
"</div>"
],
"text/plain": [
"      age  Medu      Mjob      Fjob  guardian  studytime
failures  schoolsup  \\\n",
"0      18      4.0    at_home  teacher          0          0
0.0      1.0    \n",
"1      17      1.0    at_home   other          0          0
0.0      0.0    \n",
"2      15      1.0    at_home   other          0          0
3.0      1.0    \n",
"3      15      4.0    health   other          0          1
0.0      0.0    \n",
"4      16      3.0     other   other          0          0
0.0      0.0    \n",
"\n",
"      paid  nursery  higher  internet  romantic  absences
score \n",
"0      0.0      1.0      1.0      NaN      0.0      1
30.0 \n",
"1      0.0      0.0      1.0      1.0      0.0      1
30.0 \n",
"2      NaN      1.0      1.0      1.0      NaN      1
50.0 \n",
"3      1.0      1.0      1.0      1.0      1.0      1
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"stud_math_for_model = stud_math.loc[:, ['age', 'Medu', 'Mjob',
'Fjob', 'guardian', 'studytime',\n",
"      'failures',
'schoolsup', 'paid', 'nursery', 'higher', 'internet', 'romantic',
'absences', 'score']]\n",
"stud_math_for_model.head()"
]
},
{
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"metadata": {},
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"cell type": "markdown",

```

```

"metadata": {},
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  "В результате EDA для анализа влияния параметров различных
аспектов жизни учеников на результаты экзамена по математике были
получены следующие выводы:\n",
  "\n",
  "1. В данных достаточно мало значений, в значимых переменных
достаточно мало пустых значений, некоторые можно заполнить
среднестатистическими значениями.\n",
  "2. Выбросы найдены только в столбцах с уровнем образования
отцов, семейные отношения и пропуски занятий, что позволяет сделать
вывод о том, что данные достаточно чистые.\n",
  "3. Данные по колонкам 'Guardian', 'schoolsup', 'famsup',
'paid', 'activities', 'nursery', 'higher', 'internet', 'romantic'
удалось оцифровать.\n",
  "4. Самые важные параметры, которые предлагается использовать в
дальнейшем для построения модели, это 'age', 'Medu', 'Mjob', 'Fjob',
'guardian', 'studytime', 'failures', 'schoolsup', 'paid', 'nursery',
'higher', 'internet', 'romantic', 'absences', 'score'."
]
},
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      "version": 3
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