```
{
 "cells": [
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "mMcWEbFiLKvn"
   },
   "source": [
    "# NumPy Exercises \n",
    "\n",
    "Now that we've learned about NumPy let's test your knowledge. We'll start off with a few simple tasks, and then you'll be asked some more complicated questions."
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "DvBjXHM1LKvw"
   },
   "source": [
    "#### Import NumPy as np"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 1,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "StInvTamLKv0"
   },
   "outputs": [],
   "source": [
    "import numpy as np\n"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "qav3VCgyLKv5"
   },
   "source": [
    "#### Create an array of 10 zeros "
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 2,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "gLlF23CdLKv6",
    "outputId": "824bc0c2-05e8-4a2f-b02c-803eb133cb1e"
   },
```

```
  "outputs": [
   {
    "data": {
     "text/plain": [
      "array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0.])"
     ]
    },
    "execution_count": 2,
    "metadata": {},
    "output_type": "execute_result"
   }
  ],
  "source": [
   "np.zeros(10)"
  ]
 },
 {
  "cell_type": "markdown",
  "metadata": {
   "colab_type": "text",
   "id": "-r7m8k4vLKv_"
  },
  "source": [
   "#### Create an array of 10 ones"
  ]
 },
 {
  "cell_type": "code",
  "execution_count": 3,
  "metadata": {
   "colab": {},
   "colab_type": "code",
   "id": "iwuCBhvcLKwB",
   "outputId": "2358e05b-b357-4b0e-d4c4-fefc91889469"
  },
  "outputs": [
   {
    "data": {
     "text/plain": [
      "array([1., 1., 1., 1., 1., 1., 1., 1., 1., 1.])"
     ]
    },
    "execution_count": 3,
    "metadata": {},
    "output_type": "execute_result"
   }
  ],
  "source": [
   "np.ones(10)"
  ]
 },
 {
  "cell_type": "markdown",
  "metadata": {
   "colab_type": "text",
   "id": "FIcddv6lLKwO"
  },
  "source": [
```

```
    "#### Create an array of 10 fives"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 4,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "tXDJ5b8cLKwU",
    "outputId": "f784a7d9-a26d-4d97-eeee-15e78e84b014"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([5., 5., 5., 5., 5., 5., 5., 5., 5., 5.])"
      ]
     },
     "execution_count": 4,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "np.ones(10)*5"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "4UInvEwQLKwg"
   },
   "source": [
    "#### Create an array of the integers from 10 to 50"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 5,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "Z9kAbHHiLKwj",
    "outputId": "1b2d4a50-b3c4-44af-dd3b-643a6546d019"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23,
24, 25, 26,\n",
       "       27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40,
41, 42, 43,\n",
       "       44, 45, 46, 47, 48, 49, 50])"
      ]
     },
```

```
      "execution_count": 5,
      "metadata": {},
      "output_type": "execute_result"
     }
    ],
    "source": [
     "np.arange(10,51)"
    ]
   },
   {
    "cell_type": "markdown",
    "metadata": {
     "colab_type": "text",
     "id": "3ZUIzdDeLKww"
    },
    "source": [
     "#### Create an array of all the even integers from 10 to 50"
    ]
   },
   {
    "cell_type": "code",
    "execution_count": 6,
    "metadata": {
     "colab": {},
     "colab_type": "code",
     "id": "dVVfz73BLKw5",
     "outputId": "ee6de97d-f84f-4f4b-d6d6-c21c46f59666"
    },
    "outputs": [
     {
      "data": {
       "text/plain": [
        "array([10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36,
38, 40, 42,\n",
        "       44, 46, 48, 50])"
       ]
      },
      "execution_count": 6,
      "metadata": {},
      "output_type": "execute_result"
     }
    ],
    "source": [
     "np.arange(10,51,2)"
    ]
   },
   {
    "cell_type": "markdown",
    "metadata": {
     "colab_type": "text",
     "id": "6e200i5-LKxB"
    },
    "source": [
     "#### Create a 3x3 matrix with values ranging from 0 to 8"
    ]
   },
   {
    "cell_type": "code",
```

```
   "execution_count": 8,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "6ODYRVCxLKxF",
    "outputId": "0327b8fd-1f75-4da0-ddbc-9193a7cbbd3d"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([[0, 1, 2],\n",
       "       [3, 4, 5],\n",
       "       [6, 7, 8]])"
      ]
     },
     "execution_count": 8,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "np.arange(0,9).reshape(3,3)"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "54wb4NboLKxN"
   },
   "source": [
    "#### Create a 3x3 identity matrix"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 9,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "j8JQg-VSLKxT",
    "outputId": "697e3eed-3266-4f57-90ab-ff5d5c430c7d"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([[1., 0., 0.],\n",
       "       [0., 1., 0.],\n",
       "       [0., 0., 1.]])"
      ]
     },
     "execution_count": 9,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
```

```
   "source": [
    "np.identity(3)"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "_bpkEUARLKxa"
   },
   "source": [
    "#### Use NumPy to generate a random number between 0 and 1"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 10,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "Co4I1qACLKxc",
    "outputId": "efdd03f8-868e-4eeb-e40f-e75dba4cd14e"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "0.12288700857181267"
      ]
     },
     "execution_count": 10,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "np.random.rand()"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "7Qix8s61LKxp"
   },
   "source": [
    "#### Use NumPy to generate an array of 25 random numbers sampled
from a standard normal distribution"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 11,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "eUgQBgpQLKxs",
    "outputId": "04664997-3ff0-421e-b92e-5e12c80321f9"
```

```
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([-0.59025001, -1.99959799, -0.28682875, -0.32577217,
0.60633553,\n",
       "       -0.18280859,  0.26654057, -2.82191982, -1.57317304, -
0.5028952 ,\n",
       "       -0.42923954,  2.70292732,  0.00556435, -0.50110771, -
0.435243  ,\n",
       "       -0.92847584,  0.02910693, -0.39396404,  0.86349732,
0.00915186,\n",
       "        2.28450257,  0.08561441, -0.14847465, -0.49125291,
0.45451702])"
      ]
     },
     "execution_count": 11,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "np.random.standard_normal(25)"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "-sL9HYlWLKx1"
   },
   "source": [
    "#### Create the following matrix:"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 13,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "p2pm5Mm6LKx5",
    "outputId": "aa76f1ed-5967-4d3d-8061-72f82595c599"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1
, 0.11,\n",
       "       0.12, 0.13, 0.14, 0.15, 0.16, 0.17, 0.18, 0.19, 0.2 ,
0.21, 0.22,\n",
       "       0.23, 0.24, 0.25, 0.26, 0.27, 0.28, 0.29, 0.3 , 0.31,
0.32, 0.33,\n",
       "       0.34, 0.35, 0.36, 0.37, 0.38, 0.39, 0.4 , 0.41, 0.42,
0.43, 0.44,\n",
```

"   0.45, 0.46, 0.47, 0.48, 0.49, 0.5 , 0.51, 0.52, 0.53,
0.54, 0.55,\n",
"   0.56, 0.57, 0.58, 0.59, 0.6 , 0.61, 0.62, 0.63, 0.64,
0.65, 0.66,\n",
"   0.67, 0.68, 0.69, 0.7 , 0.71, 0.72, 0.73, 0.74, 0.75,
0.76, 0.77,\n",
"   0.78, 0.79, 0.8 , 0.81, 0.82, 0.83, 0.84, 0.85, 0.86,
0.87, 0.88,\n",
"   0.89, 0.9 , 0.91, 0.92, 0.93, 0.94, 0.95, 0.96, 0.97,
0.98, 0.99])"
      ]
     },
     "execution_count": 13,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "np.arange(1,100)/100"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "UQzj3r7NLKx_"
   },
   "source": [
    "#### Create an array of 20 linearly spaced points between 0 and 1:"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 14,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "AniTWWz9LKyC",
    "outputId": "dfb092f8-2f1e-446a-99e2-5c6df71631ac"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([0.   , 0.05263158, 0.10526316, 0.15789474,
0.21052632,\n",
       "   0.26315789, 0.31578947, 0.36842105, 0.42105263,
0.47368421,\n",
       "   0.52631579, 0.57894737, 0.63157895, 0.68421053,
0.73684211,\n",
       "   0.78947368, 0.84210526, 0.89473684, 0.94736842, 1.
])"
      ]
     },
     "execution_count": 14,
     "metadata": {},
     "output_type": "execute_result"
    }

```
   ],
   "source": [
    "np.linspace()"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "i3vsM3rPLKyK"
   },
   "source": [
    "## Numpy Indexing and Selection\n",
    "\n",
    "Now you will be given a few matrices, and be asked to replicate the
resulting matrix outputs:"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 16,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "AM_s5FAvLKyN",
    "outputId": "b29d6933-31ca-4d45-d4c9-123877d1e7be"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([[ 1,  2,  3,  4,  5],\n",
       "       [ 6,  7,  8,  9, 10],\n",
       "       [11, 12, 13, 14, 15],\n",
       "       [16, 17, 18, 19, 20],\n",
       "       [21, 22, 23, 24, 25]])"
      ]
     },
     "execution_count": 16,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "mat = np.arange(1,26).reshape(5,5)\n",
    "mat"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 17,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "rxlUOQ4dLKyX"
   },
   "outputs": [],
   "source": [
```

```
    "# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW\n",
    "# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T\n",
    "# BE ABLE TO SEE THE OUTPUT ANY MORE"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 18,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "2BJ3cylOLKyf",
    "outputId": "ab55bbee-37f2-4797-bad5-4ed340f4d684"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([[12, 13, 14, 15],\n",
       "       [17, 18, 19, 20],\n",
       "       [22, 23, 24, 25]])"
      ]
     },
     "execution_count": 18,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "mat[2:,1:]"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 0,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "9-U53vNoLKyw"
   },
   "outputs": [],
   "source": [
    "# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW\n",
    "# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T\n",
    "# BE ABLE TO SEE THE OUTPUT ANY MORE"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 19,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "QJyclCVfLKy6",
    "outputId": "9762e12a-13fe-4567-fd7a-718402be1edb"
   },
   "outputs": [
    {
```

```
    "data": {
     "text/plain": [
      "20"
     ]
    },
    "execution_count": 19,
    "metadata": {},
    "output_type": "execute_result"
   }
  ],
  "source": [
   "mat[3,4]"
  ]
 },
 {
  "cell_type": "code",
  "execution_count": 0,
  "metadata": {
   "colab": {},
   "colab_type": "code",
   "id": "E_PuvjL5LKzH"
  },
  "outputs": [],
  "source": [
   "# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW\n",
   "# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T\n",
   "# BE ABLE TO SEE THE OUTPUT ANY MORE"
  ]
 },
 {
  "cell_type": "code",
  "execution_count": 20,
  "metadata": {
   "colab": {},
   "colab_type": "code",
   "id": "TzFTd7eHLKzY",
   "outputId": "5aa2b71d-7d91-4bbd-8550-46aa7e62385d"
  },
  "outputs": [
   {
    "data": {
     "text/plain": [
      "array([[ 2],\n",
      "       [ 7],\n",
      "       [12]])"
     ]
    },
    "execution_count": 20,
    "metadata": {},
    "output_type": "execute_result"
   }
  ],
  "source": [
   "mat[:3, 1].reshape(3,1)"
  ]
 },
 {
  "cell_type": "code",
```

```
   "execution_count": 0,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "BaybacXxLKze"
   },
   "outputs": [],
   "source": [
    "# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW\n",
    "# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T\n",
    "# BE ABLE TO SEE THE OUTPUT ANY MORE"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 21,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "hvblpMEFLKzl",
    "outputId": "95ecd0ff-f24a-4e5f-edae-481966a15a0a"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([21, 22, 23, 24, 25])"
      ]
     },
     "execution_count": 21,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "mat[4,:]"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 0,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "L0SoIZfILKzr"
   },
   "outputs": [],
   "source": [
    "# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW\n",
    "# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T\n",
    "# BE ABLE TO SEE THE OUTPUT ANY MORE"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 22,
   "metadata": {
    "colab": {},
```

```
    "colab_type": "code",
    "id": "h2NmY81aLKzv",
    "outputId": "ec3006aa-5bd4-43ef-b876-f0475c9a26ce"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([[16, 17, 18, 19, 20],\n",
       "       [21, 22, 23, 24, 25]])"
      ]
     },
     "execution_count": 22,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "mat[3:,:]"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "40ijP69QLKz6"
   },
   "source": [
    "### Now do the following"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "id": "hJYmPKZ6LKz7"
   },
   "source": [
    "#### Get the sum of all the values in mat"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 23,
   "metadata": {
    "colab": {},
    "colab_type": "code",
    "id": "lgjWcsNHLKz9",
    "outputId": "a4aebb34-800e-490a-94fa-b2f29e05ec8a"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "325"
      ]
     },
     "execution_count": 23,
```

```
    "metadata": {},
    "output_type": "execute_result"
   }
  ],
  "source": [
   "mat.sum()"
  ]
 },
 {
  "cell_type": "markdown",
  "metadata": {
   "colab_type": "text",
   "id": "aOxAVLe8LK0B"
  },
  "source": [
   "#### Get the standard deviation of the values in mat"
  ]
 },
 {
  "cell_type": "code",
  "execution_count": 24,
  "metadata": {
   "colab": {},
   "colab_type": "code",
   "id": "1bExi0tvLK0D",
   "outputId": "cdcf114d-bcd3-494a-afc8-f4b592566334"
  },
  "outputs": [
   {
    "data": {
     "text/plain": [
      "7.211102550927978"
     ]
    },
    "execution_count": 24,
    "metadata": {},
    "output_type": "execute_result"
   }
  ],
  "source": [
   "mat.std()"
  ]
 },
 {
  "cell_type": "markdown",
  "metadata": {
   "colab_type": "text",
   "id": "qWvkrLQWLK0H"
  },
  "source": [
   "#### Get the sum of all the columns in mat"
  ]
 },
 {
  "cell_type": "code",
  "execution_count": 25,
  "metadata": {
   "colab": {},
```

```
    "colab_type": "code",
    "id": "-XFw4SD1LK0J",
    "outputId": "03cee652-bdb1-411c-a81f-7534525a3d21"
   },
   "outputs": [
    {
     "data": {
      "text/plain": [
       "array([ 15,  40,  65,  90, 115])"
      ]
     },
     "execution_count": 25,
     "metadata": {},
     "output_type": "execute_result"
    }
   ],
   "source": [
    "mat.sum(axis=1)"
   ]
  },
  {
   "cell_type": "markdown",
   "metadata": {
    "colab_type": "text",
    "collapsed": true,
    "id": "x75g5hGlLK0N"
   },
   "source": []
  }
 ],
 "metadata": {
  "colab": {
   "name": "Numpy Exercise .ipynb",
   "provenance": []
  },
  "kernelspec": {
   "display_name": "Python 3 (ipykernel)",
   "language": "python",
   "name": "python3"
  },
  "language_info": {
   "codemirror_mode": {
    "name": "ipython",
    "version": 3
   },
   "file_extension": ".py",
   "mimetype": "text/x-python",
   "name": "python",
   "nbconvert_exporter": "python",
   "pygments_lexer": "ipython3",
   "version": "3.9.7"
  }
 },
 "nbformat": 4,
 "nbformat_minor": 1
}
```