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MLADS

MACHINE LEARNING, AI,
AND DATA SCIENCE CONFERENCE

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Microsoft

Introduction to Python

Shep Sheppard
shep.sheppard@microsoft.com
https://www.linkedin.com/in/sqlshep/
@sqlshep

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Introduction to Python

Shep Sheppard
Customer Engineer
Fast Track ISV

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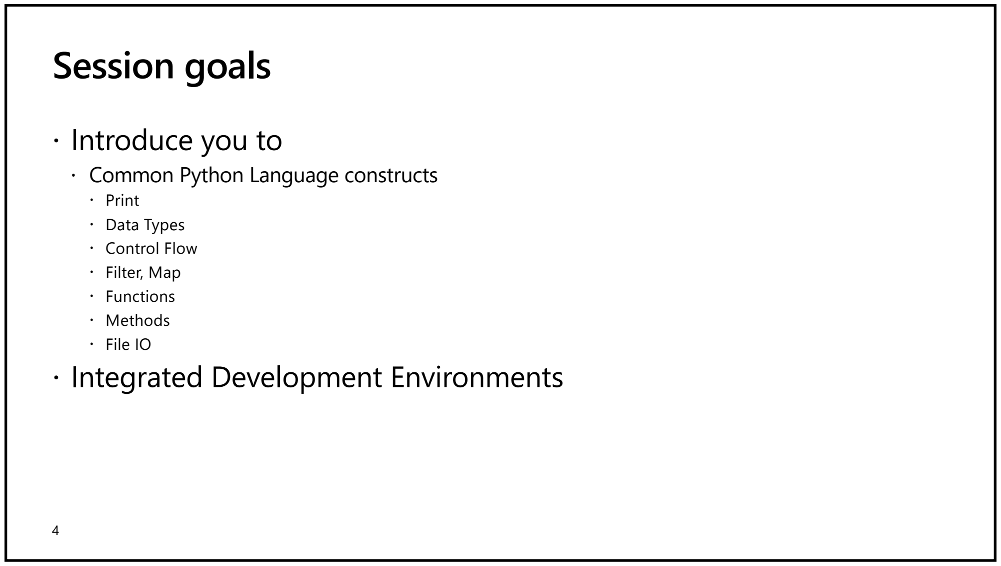

Session goals

- Introduce you to
  - Common Python Language constructs
    - Print
    - Data Types
    - Control Flow
    - Filter, Map
    - Functions
    - Methods
    - File IO
- Integrated Development Environments

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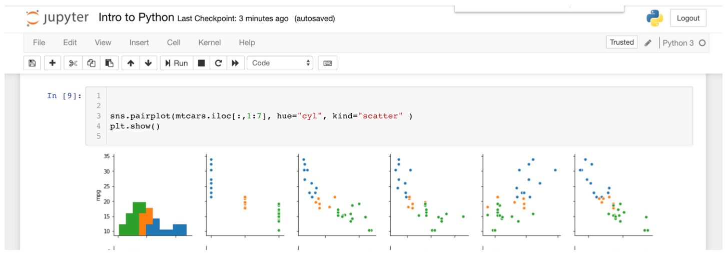
IDE's and Notebooks

- Jupyter notebook is an open-source web based application that allows code, equations, LaTex, Markup, data visualizations.
- Typically used for exploration, data cleaning, transformation, stats, machine learning



```
sns.pairplot(mtcars.iloc[:,1:7], hue="cyl", kind="scatter" )
plt.show()
```

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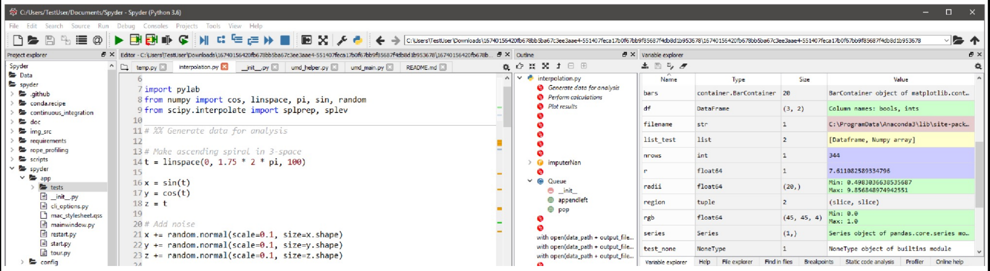
Interactive IDE - Spyder

- Spyder is a more typical IDE interface "designed by and for scientists, engineers and data analysts"



```
import pylab
from numpy import cos, linspace, pi, sin, random
from scipy.interpolate import splprep, splev

# %% Generate data for analysis

# Make ascending spiral in 3-space
t = linspace(0, 1.75 * 2 * pi, 100)

x = sin(t)
y = cos(t)
z = t

# Add noise
x += random.normal(scale=0.1, size=x.shape)
y += random.normal(scale=0.1, size=y.shape)
z += random.normal(scale=0.1, size=z.shape)
```

Name	Type	Size	Value
bars	container.BarContainer	20	BarContainer object of matplotlib.cont…
df	DataFrame	(3, 2)	Column names: bools, ints
filename	str	1	C:\ProgramData\Anaconda3\lib\site-pack…
list_test	list	2	[Dataframe, Numpy array]
nrows	int	1	344
r	float64	1	7.611082589334796
radii	float64	(20,)	Min: 0.4983036638535687 Max: 9.856848974942551
region	tuple	2	(slice, slice)
rgb	float64	(45, 45, 4)	Min: 0.0 Max: 1.0
series	Series	(1,)	Series object of pandas.core.series mo…
test_none	NoneType	1	NoneType object of builtins module

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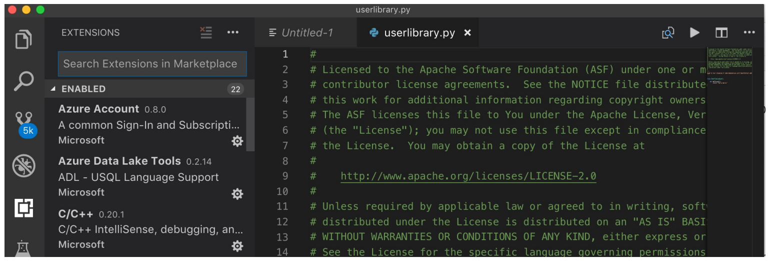
Interactive IDE – Visual Studio Code

- Visual Studio Code is open source and mulit-platform multi language code editor
- IntelliSense, Git integration, thousands of extensions, integrated debugging



Azure Account 0.8.0
A common Sign-In and Subscripti...
Microsoft

Azure Data Lake Tools 0.2.14
ADL - USQL Language Support
Microsoft

C/C++ 0.20.1
C/C++ IntelliSense, debugging, an...
Microsoft

```
#
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```

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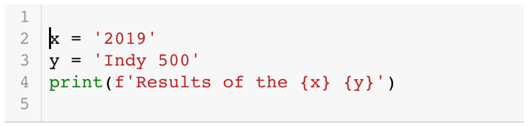
Printing

- print() statement will output a string, formatted string or number to console or notebook
- Used for simple out put or debugging code on the fly
- "f" known as the formatted string literal can format and output, not supported in Databricks Python distribution
- In a notebook, unless all lines use print only last print will display



```

x = '2019'
y = 'Indy 500'
print(f'Results of the {x} {y}')

```

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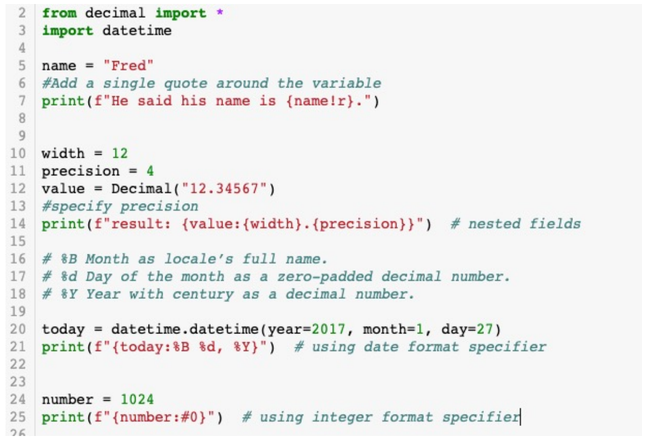
Format String Literals

- Slightly more advanced literals in the print statement



```python
from decimal import *
import datetime

name = "Fred"
#Add a single quote around the variable
print(f"He said his name is {name!r}.")


width = 12
precision = 4
value = Decimal("12.34567")
#specify precision
print(f"result: {value:{width}.{precision}}")  # nested fields

# %B Month as locale’s full name.
# %d Day of the month as a zero-padded decimal number.
# %Y Year with century as a decimal number.

today = datetime.datetime(year=2017, month=1, day=27)
print(f"{today:%B %d, %Y}")  # using date format specifier


number = 1024
print(f"{number:#0}")  # using integer format specifier
```

Types

- type(object) – find out what is it?
- Boolean – Ture or False
- Numeric types
  - Int, float
  - complex - Real and imaginary
- Text – String
- Sequence
  - List, tuple, range
- Binary
  - Byte, Byte array

- Comparisons

<	strict less than
<=	less than or equal
>	strict greater than
>=	greater than or equal
==	equal
!=	not equal
is	object identity
“is not”	negate object identity

Operations on Numeric Types

+	sum	int()	convert to int
-	difference	float()	convert to float
*	product	divmod()	(x // y, x % y)
/	divide or quotient	pow(x,y)	x to the power of y
//	floored quotient	x**y	x to the power of y
%	remainder (modulo)	complex(re, im)	
-x	negate	c.conjugate()	conjugate a complex
+x	unchanged		
abs()	absolute		

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Sequence Types

- Basic Sequences include list, tuple and range
- list([iterable]) – construct of items of the same type
- tuples([iterable]) – immutable sequences
- range(start, stop, [step]) - immutable sequence of numbers

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List []

- Mutable Array of compound data types
- Versatile in that can store a mix of values
- Can store more than one dimension of data
- For more than 2 dimensions of data consider using numpy
- Methods for append, iterating and removing elements via pop and remove

```
myList = ["One", "Two", "Three", "Four","Five", "Six", "Seven"]

myList = [["One",1], ["Two",2],["Three",3], ["Four",4,], ["Five",5]]
```

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Tuple ()

- Immutable Array of compound data types
- Versatile in that can store a mix of values
- Can store more than one dimension of data
- Few methods since it is read only

```

my2dTuple = (["One",1], ["Two",2],["Three",3], ["Four",4,], ["Five",5])

my2dTuple[3][0]


```

```
'Four'
```

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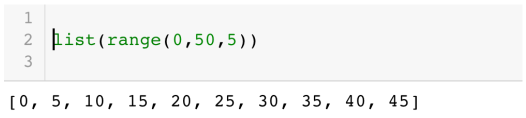
Range

- Immutable sequence of numbers
- Typically used for looping
- range(*start*, *stop*[, *step*])



```
list(range(0,50,5))
```

```
[0, 5, 10, 15, 20, 25, 30, 35, 40, 45]
```

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Indexing

- Used for accessing specific dimensions of lists, tuples and arrays
- myList[:]   - returns everything
- myList[:100] - return the first 100 rows
- myList[100:] – return everything after the first 100 rows
- myList[100:200] return everything between index 100 and 200

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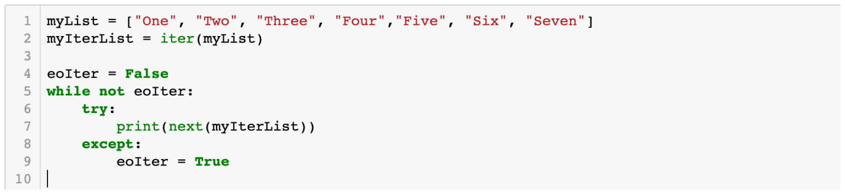
Iterator

- An object representing a stream of data
- Repeated calls to the iterator’s next() method or passing it to the built-in function next() return successive items in the stream.
- Can be created from list, tuple, or range



```
myList = ["One", "Two", "Three", "Four","Five", "Six", "Seven"]
myIterList = iter(myList)

eoIter = False
while not eoIter:
    try:
        print(next(myIterList))
    except:
        eoIter = True

```

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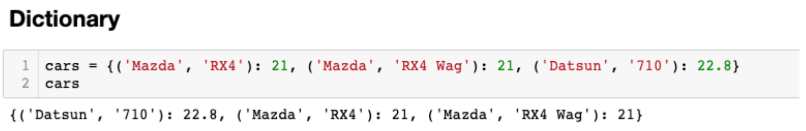
Dictionary

- Store Key Value pairs
- Mutable
- Unordered collection
- Iterable
- Cannot mutate a dictionary while iterating it



Dictionary

```
cars = {('Mazda', 'RX4'): 21, ('Mazda', 'RX4 Wag'): 21, ('Datsun', '710'): 22.8}
cars
```

```
{('Datsun', '710'): 22.8, ('Mazda', 'RX4'): 21, ('Mazda', 'RX4 Wag'): 21}
```

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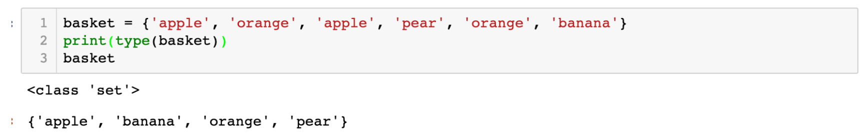
Sets {}

- Use the keyword set or {}
- An unordered collection of unique elements
- Support union and intersect operations



```
basket = {'apple', 'orange', 'apple', 'pear', 'orange', 'banana'}
print(type(basket))
basket
```

```
<class 'set'>
```

```
{'apple', 'banana', 'orange', 'pear'}
```

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Common Control Flow statements

- If - test condition using operator
  - Elif – (optional) test condition inside if
  - Else – (optional) if and elif do not match run else
- For – while some condition true, loop
- While – while some condition is true
- Break – break out of loop

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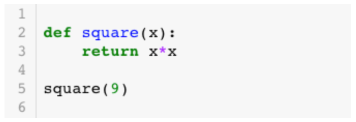
Functions

- Reusable code
- Functions are the definition of an executable statement
- The function only executed when called explicitly
- Functions can accept a series of inputs and return an output or simply execute on the input
- Variables created in the function are only scoped to the function



```python

def square(x):
    return x*x

square(9)

```

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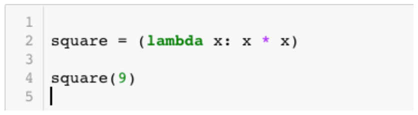
Anonymous Functions

- Lambda is small anonymous function
- The are syntactically restricted to a single expression
- Lambda functions can reference variables form the containing scope



```python

square = (lambda x: x * x)

square(9)

```

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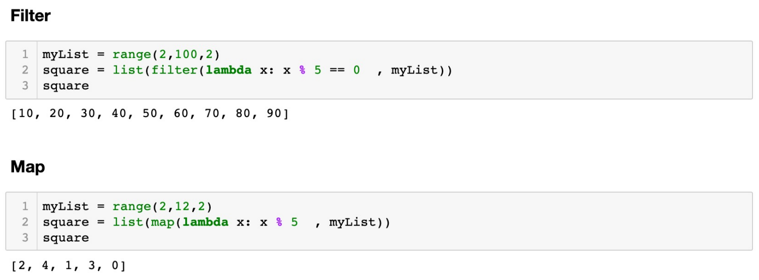
Filter, Map

- Map will return an iterator that applies function to every item of iterable
- Filter returns an iterable list of elements for which function returns true



Filter

```
myList = range(2,100,2)
square = list(filter(lambda x: x % 5 == 0  , myList))
square
```

```
[10, 20, 30, 40, 50, 60, 70, 80, 90]
```

Map

```
myList = range(2,12,2)
square = list(map(lambda x: x % 5  , myList))
square
```

```
[2, 4, 1, 3, 0]
```

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Methods

- Canonically, a method is a procedure associated with a class object
- Different object types have different methods

- String.capitalize()
- String.count()
- String.lower()
- String.replace()
- String.split()

- List.append()
- List.remove()
- List.pop()
- List.clear()
- List.sort()

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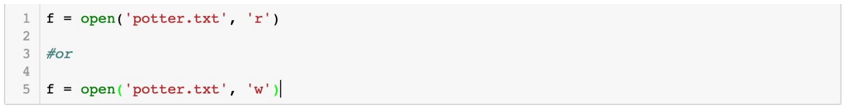
Python File IO

- Built in python functions for reading and writing
- Files are typically opened in text mode, indicating you read and write strings.
- Binary files are supported by opening with the "b" option
- Read is supported with the "r" option
- Write is supported with the "w" option
- Combine with "rb+"



```
f = open('potter.txt', 'r')

#or

f = open('potter.txt', 'w')
```

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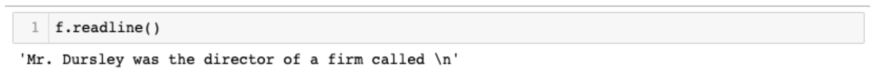
File IO

- Reading and writing are done via python methods
- File.read() – read the entire file
- File.readline() – read the next line
- File.seek(5) – goto the 6th byte in the file
- File.write("string") – will write string to the open file(overwrite)
- File.close() when you are done



```
f.readline()
'Mr. Dursley was the director of a firm called \n'
```

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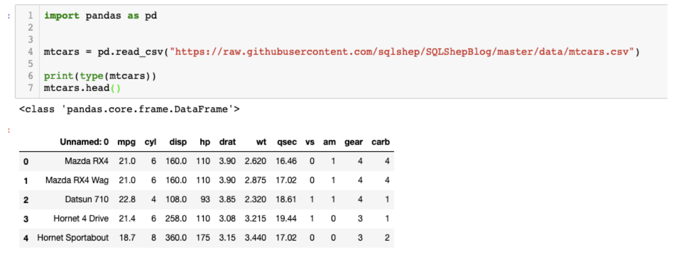
IO with CSV and URL

- It is likely you will not be interested in file io using python read or write
- Third party packages make life easier with read from csv, url, etc…
- Pandas package will read csv from URL or disk and import as a dataframe



```python
import pandas as pd


mtcars = pd.read_csv("https://raw.githubusercontent.com/sqlshep/SQLShepBlog/master/data/mtcars.csv")

print(type(mtcars))
mtcars.head()
```

```
<class 'pandas.core.frame.DataFrame'>
```

	Unnamed: 0	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
0	Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
1	Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
2	Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
3	Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
4	Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2

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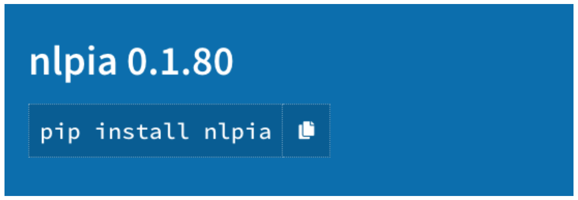
Packages

- Packages are an external collection of Python functions, methods and types.
- Packages are typically specific to the problem they are trying to solve
- There are thousands packages available to be downloaded
- Easily installed via pip in the OS of your choice



nlpia 0.1.80

```
pip install nlpia
```

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Top Packages for Data Science

- **TensorFlow** - is an open source software library for numerical computation using data flow graphs.
- **Pandas** - a fast, flexible, and expressive data structures designed to make working with "relational" or "labeled" data both easy and intuitive.
- **scikit-learn** – Built on Numpy and SciPy provides data mining and analytictools
- **PyTorch** – Provides tensor computation and DNN
- **Matplotlib** – Python plotting library for high quality graphics
- **Keras** – Neural Network API running on TensorFlow, CNTK, and Theano
- **Numpy** – Fundamental package needed for scientific computing
- **SciPy** – Open source software for mathematics, science and engineering

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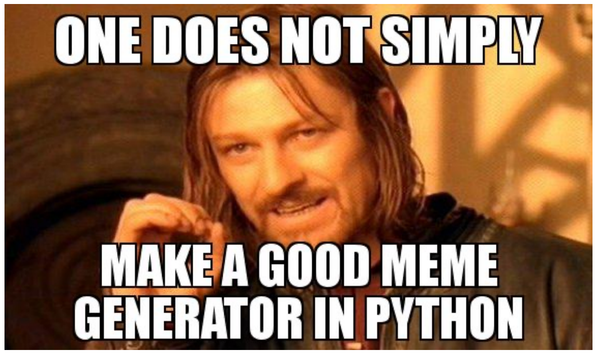
Summary

- Getting started with an IDE
- Print
- Python Data Types
- Control Flow
- Filter, Map
- Functions and Anon Functions
- Methods
- File IO



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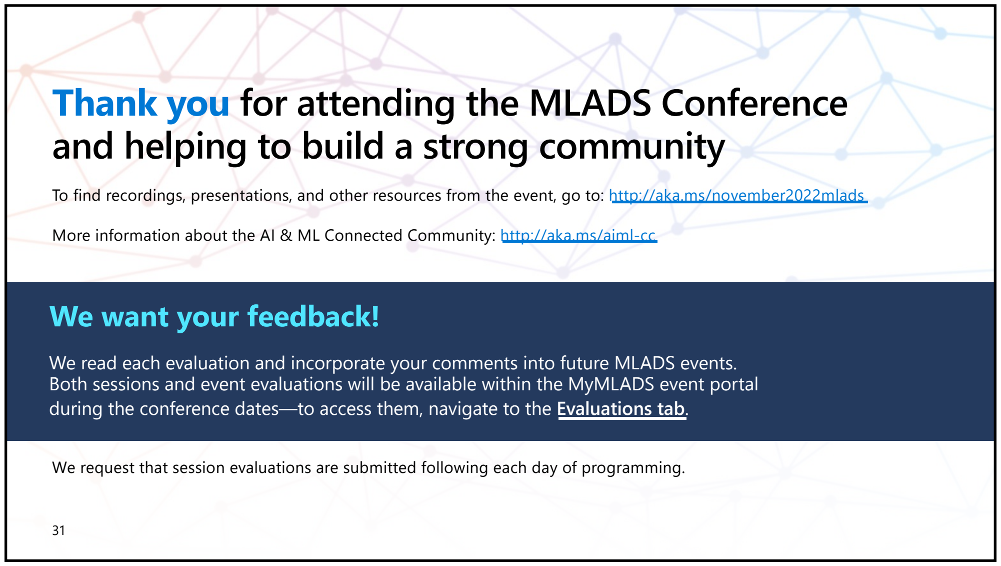

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Q&A

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