Questions & Answers

Introduction to Data Science (JBP010)

18th of December 2017

R.J. Klaasse Bos

Hi there 👋!

To help you get most out of this slide deck, please take note of the following structure:

- **Part 1:** [Question + Answer] on a single slide
- **Part 2:** Question slide (without answer) followed by [Question + Answer]

The latter may be helpful to test your memorisation super powers..

Happy memorising! ;-)

And of course… 

*"A **merry Christmas** and the **best wishes** for the new year!"*

And now back to why you are really here..

Introduction to Data Science

Part 1

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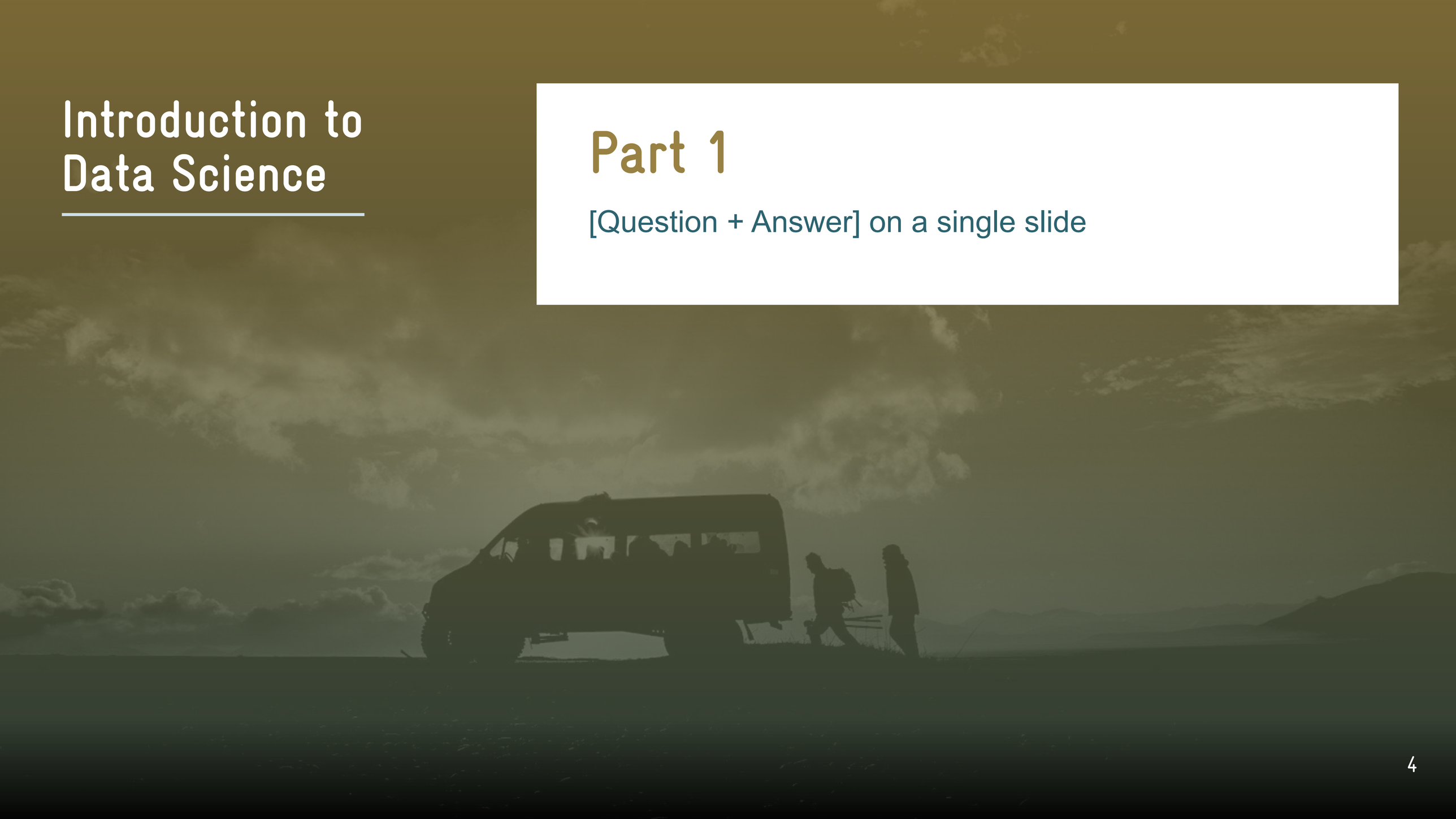

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Data processing tools that handle **Volume**, **Velocity** and **Variety**

that traditional data processing systems cannot support.

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The practice of **basing decisions** on the **analysis** of **data** rather than purely on **intuition.**

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acquire *(focus on keeping data clean),*

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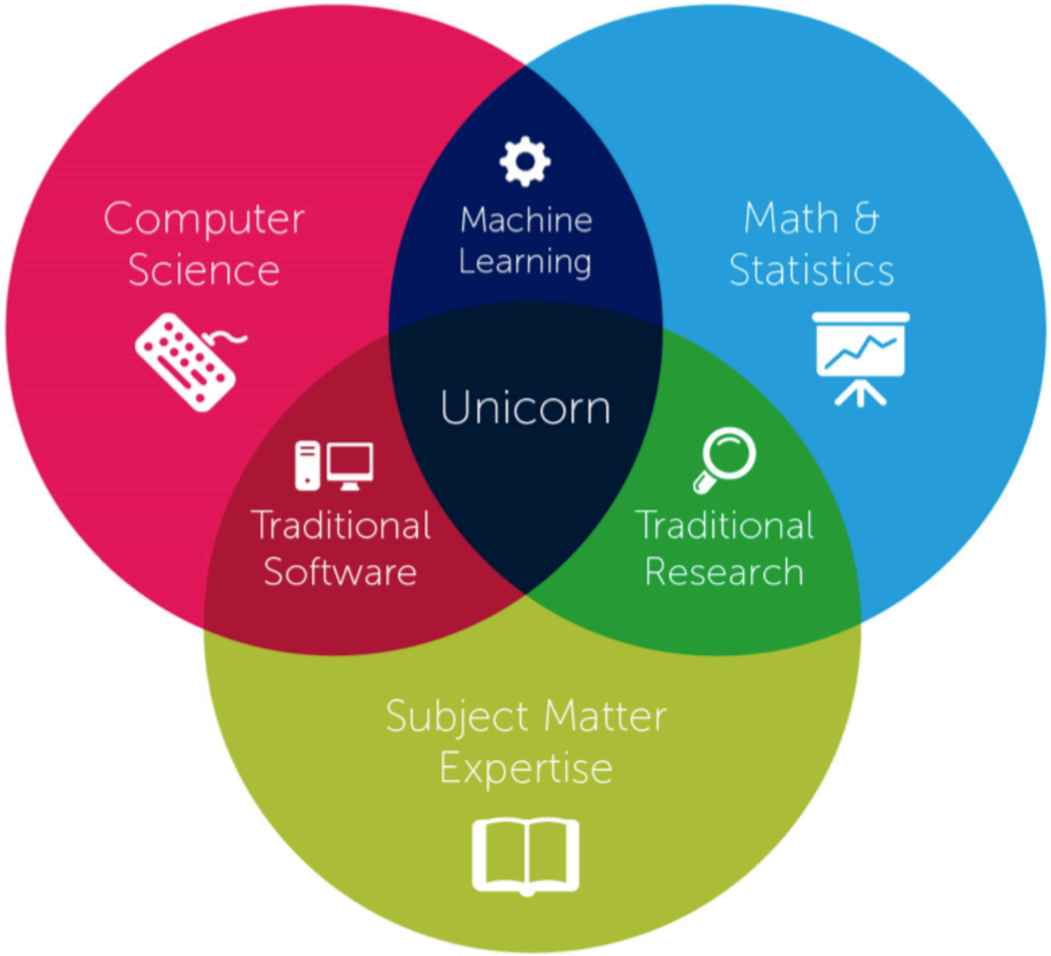

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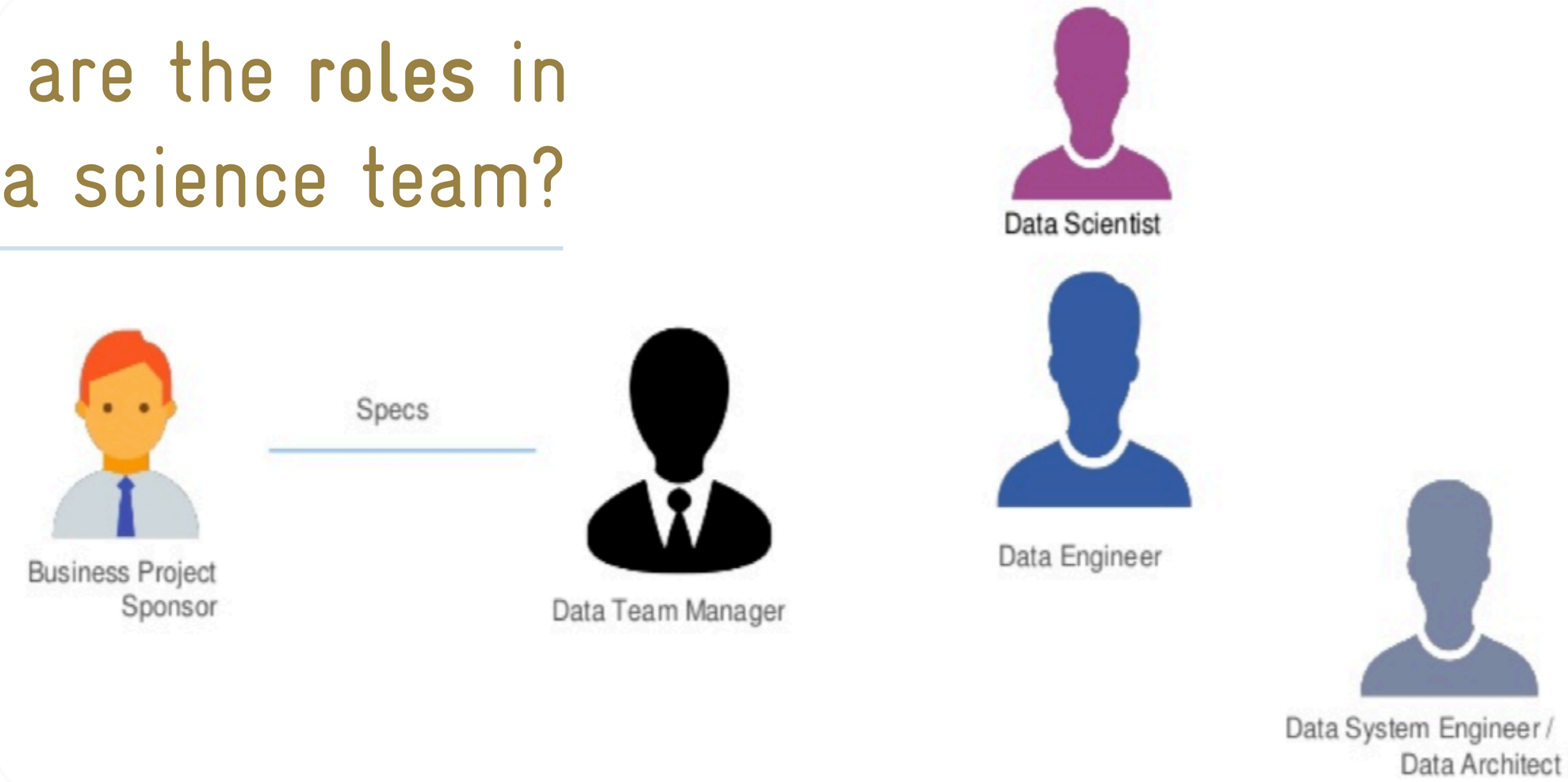

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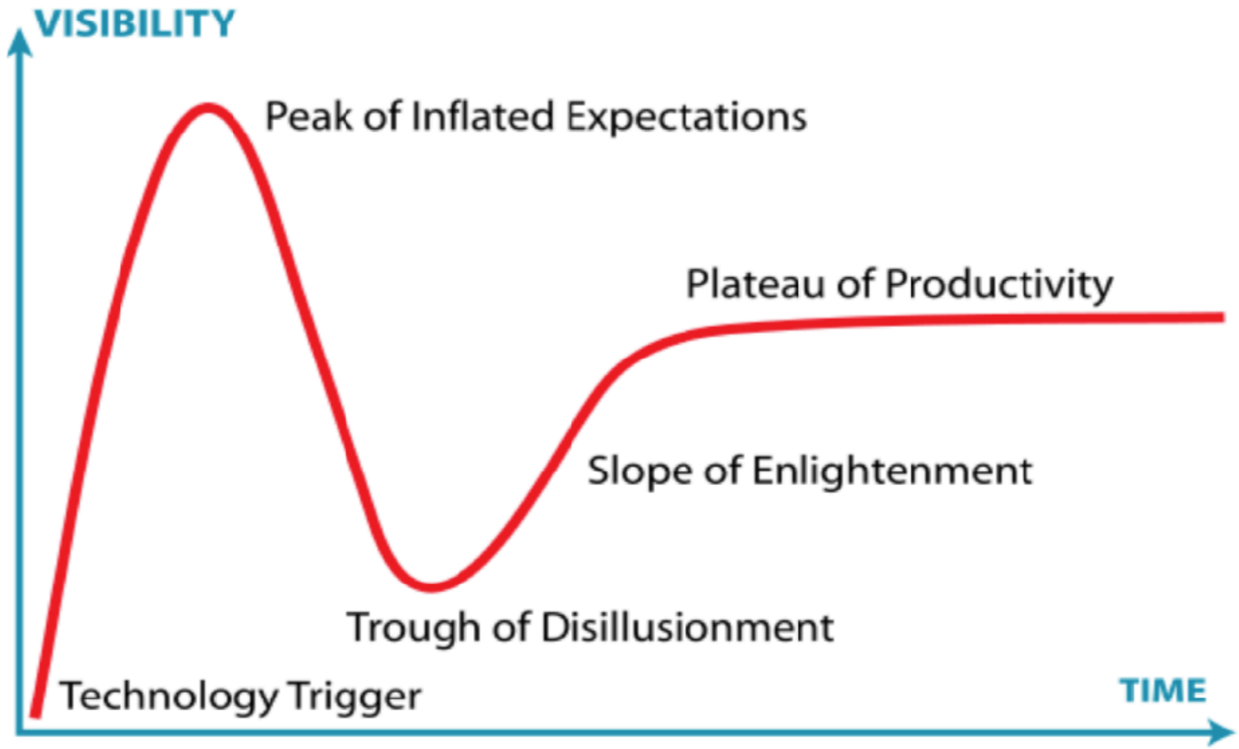

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1. **What question** are you trying to answer?
2. Do you have (**relevant**!) **data** to answer the question
3. Can we **use** the answer?

Question 20:

Which types of Analyst Archetypes are there?

1. **Hackers**
2. **Scripters**
3. **Application users**

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Can you highlight **3 key characteristics** of a **Hacker**?

1. **Most proficient programmers**
(comfortable manipulating data, masters multiple (scripting) languages)
2. **Most diverse and complex workflows**
(typically jobs at scale using distributed computing resources)
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(due to larger data sets)

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1. Focus on the **strengths**
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3a. **Reiterate positive** comments

3b. Mention **expected results** if the criticism is acted upon

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- **Descriptive** (summaries without interpretation)
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Can you name **3 characteristics** of a **good (data) question**?

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2. **Not already been answered**
3. **Answerable** (data availability, feasibility, ethics)

Question 27:

Which are the types of analytics?

- **Descriptive** *(what happened)*,
- **Diagnostic** *(why did it happen)*,
- **Predictive** *(what will happen),*
- **Prescriptive** *(what should I do)*

Question 28:

What is descriptive analytics?

- Outcome of a **descriptive / exploratory** question
- Shows what **happened** or is **happening now**
- Uses **email reports** / **dashboards**
- Requires **considerable human intervention**

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What is diagnostic analytics?

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- Looks at the **past performance** to answer: **why** did it happen?
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What is **predictive analytics**?

- Outcome of a **predictive** question
- Predicts what **will happen**
- Yields **predictive forecasts**
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Question 31:

What is prescriptive analytics?

- Outcome of a **causal / mechanistic** question
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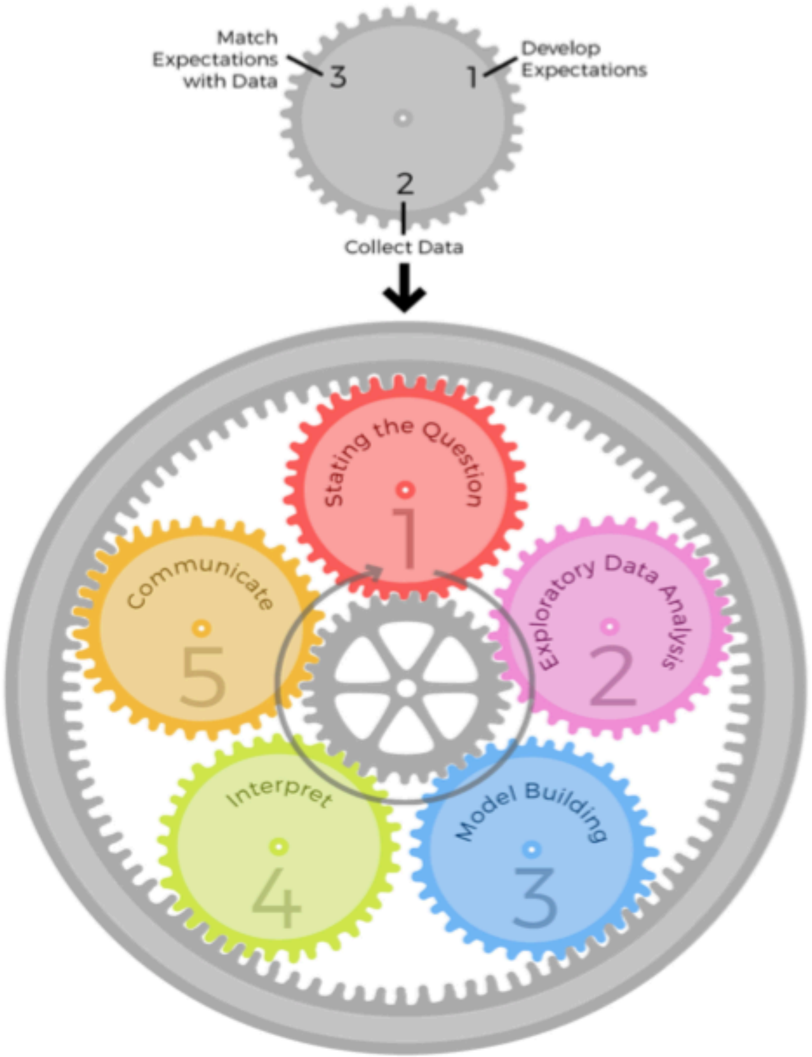
Which are the **steps** of the Data Analysis process?

1. **Stating** and **refining** the **question**
2. **Exploring** the **data**
3. **Building** formal statistical / predictive **models**
4. **Interpreting** the results
5. **Communicating** the results



Question 33:
What is Map-Reduce?

A **parallel computing programming** paradigm developed at Google used to **preprocess** and **analyse** web pages.

Question 34:
What is Hadoop?

An open-source **distributed big data file system** by Google File System

and implemented at Yahoo!

Question 35:
What is Spark?

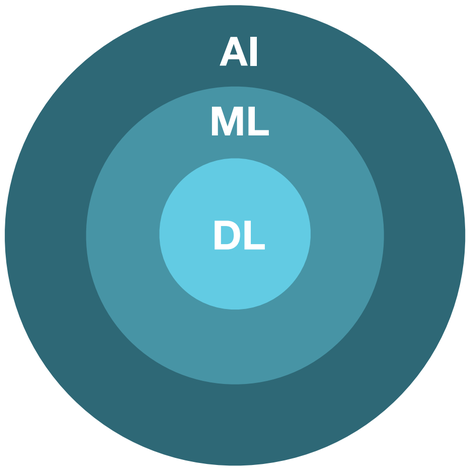
A new generation of **distributed big data processing system** that is **~10x faster** than MapReduce or Hadoop

Question 36:

What is the difference between Artificial Intelligence, Machine Learning and Deep Learning?

At the highest level, Machine Learning (ML) is a **subset** of Artificial Intelligence (AI).

In the same way, Deep Learning (DL) is a **subset** of Machine Learning.



Exists since: AI (1950), ML (1980), DL (2010)

Essence: Solve problems humans are typically better at (AI),

learn from data to make predictions (ML), mimic the human brain (DL).

Question 37:

Which are the types of Machine Learning?

There are two types of Machine Learning algorithms:

- **Supervised Learning** (*computer learns from examples*) which can be divided into:
  - Classification (*categorical target variable*)
  - Regression (*numerical target variable*)
- **Unsupervised Learning** *(computer learns the structure of the data / identifies clusters)*

Question 38:

Which are the **inputs** of a **Machine Learning algorithm**?

Inputs to ML-algorithms are **features** (i.e. the columns in a dataset).

- **Numeric format** (e.g. dates, income)
- **Signal processing** (sound/image input)
- **(Text) probability and statistics:**
  (word frequency, co-occurrences = which words are grouped together)

Question 39:

Why ensemble learning works?

By **combining** the predictions of multiple classifiers (i.e. ensembles) the **error term** of the prediction is **reduced** significantly.

Question 40:

What are the **trade-offs** in machine learning?

There are five trade-off in machine learning:

1. **Interpretability** (e.g. Decision Tree vs Random Forest)
2. **Fast** (training and testing times)
3. **Accurate** predictions
4. **Simple** to understand models (e.g. Linear Regression vs Deep Learning)
5. **Scalable** (for large data-sets)

Question 41:
Why are features important?

In a way features are the **building blocks** for any machine learning algorithm.

Using **linear algebra** features are used to fit a model to the data.

Question 42:

How can we make data linearly separable using SVM?

By applying the **Kernsel Density trick** (i.e. mapping data to a higher dimension)

Question 43:

Can you mention 3 good points of traditional statistical analyses?

1. The **parameters** of a statistical model can be easily **interpreted**
2. Statistical models are **easy** to **understand**.
3. Findings can be generalised over a **population** rather than a **sample**.

Question 44:

Can you mention 3 good points of Machine Learning?

1. It oftentimes leads to a **higher performance** than statistical models.
2. More **accurate** and **informative** alternative on **small data** sets
3. It can also be used for **large** and **complex** datasets

Question 45:

Which are the questions you should ask for creating a **business case**?

1. What is you **goal**?
2. **What** is **stopping you** from reaching that goal?
3. **How much change** is needed to overcome the problem?
4. Are you **certain** this will **solve** the **problem**?

Question 46:

Which are the 3 components of persuasion and their meaning?

1. **Logos =** the ideas make sense from the audience's point of view
2. **Ethos =** your reputation/credibility; what are you known for?
3. **Pathos =** emotional connection (e.g. by telling a personal story)

Source: https://www.youtube.com/watch?v=O2dEuMFR8kw (02:07)

Question 47:

Can you mention 5 out of 10 points to make better presentations?

1. **Turn off the computer/technology** (great ideas don't come from the computer)
2. **Put the audience first** (make them care emotionally, intellectually, aesthetically)
3. **Have a solid structure** (ideal > reality > problem > solution > next step)
4. **Remove the nonessential** (everything has a reason)
5. **Hook them early** (just get started, no formalities in advance)

Source: https://www.youtube.com/watch?v=YbV3b-I1sZs

Question 48:

What is the **mission** of start-up **Connecterra**?

“**Connecting the analogue to understand everything on earth”** (by applying AI/ML/Data Science) Ida, one of their products, is a dairy farmer’s assistant that provides meaningful insights to farmers based on cows behaviour (eating, walking, standing).

Question 49:

What is the **business-model** of the start-up **Connecterra**?

Their service to farmers is on a **subscription basis**: €7,50 per cow / month.

Question 50:

Which are the **opportunities** for Data Science in **insurance**?

The biggest opportunity is in insurance **claims** (risk based pricing / fraud detection).

Other opportunities are in **marketing** (e.g. churn), reducing **overhead** and optimising their profit **margin**.

Question 51:

How do Data Scientists at ABN Amro reduce the **variance** of **churn prediction** models?

They make use of **ensemble models** such as Random Forest. The basic idea there is that you train a classifier on **multiple random samples** of the data based on a random subset of features for each iteration.

Question 52:

What **train flow** do Data Scientists at Rabobank use?

They use a rather standard data science approach:
Select features from historic data, **prepare** the **data** (dummies for categorical variables, imputation for NAs, scaling for better performance, add interactions), **build** a **ML-model** using the H2O package, **validate** hypotheses with a statistical **test** and eventually evaluate the **model performance**.

Question 53:

Can you mention 2 **examples** of **personalisation**?

Netflix’s movie recommendation system, chatbots, Google searches, your Facebook feed, Amazon’s product recommendations, Spotify’s Discovery Weekly playlist, and many more…

Question 54:

Which are **common features** to detect **stress**?

Common features to detect stress are: **heart rate** (variability), **skin conductance level** and **respiration rate**.

Question 55:

Which are typical data sources used to rank hotels?

Trivago uses the following data sources to rank hotels:

- **Hotel** meta-data (location)
- **Ratings** (star rating, cleanliness, breakfast, etc.)
- **Facilities** (laundry, room service, pool, etc.)
- **Images** (hotel / surroundings)
- **Personal click behaviour** (how the user interacted on the site)

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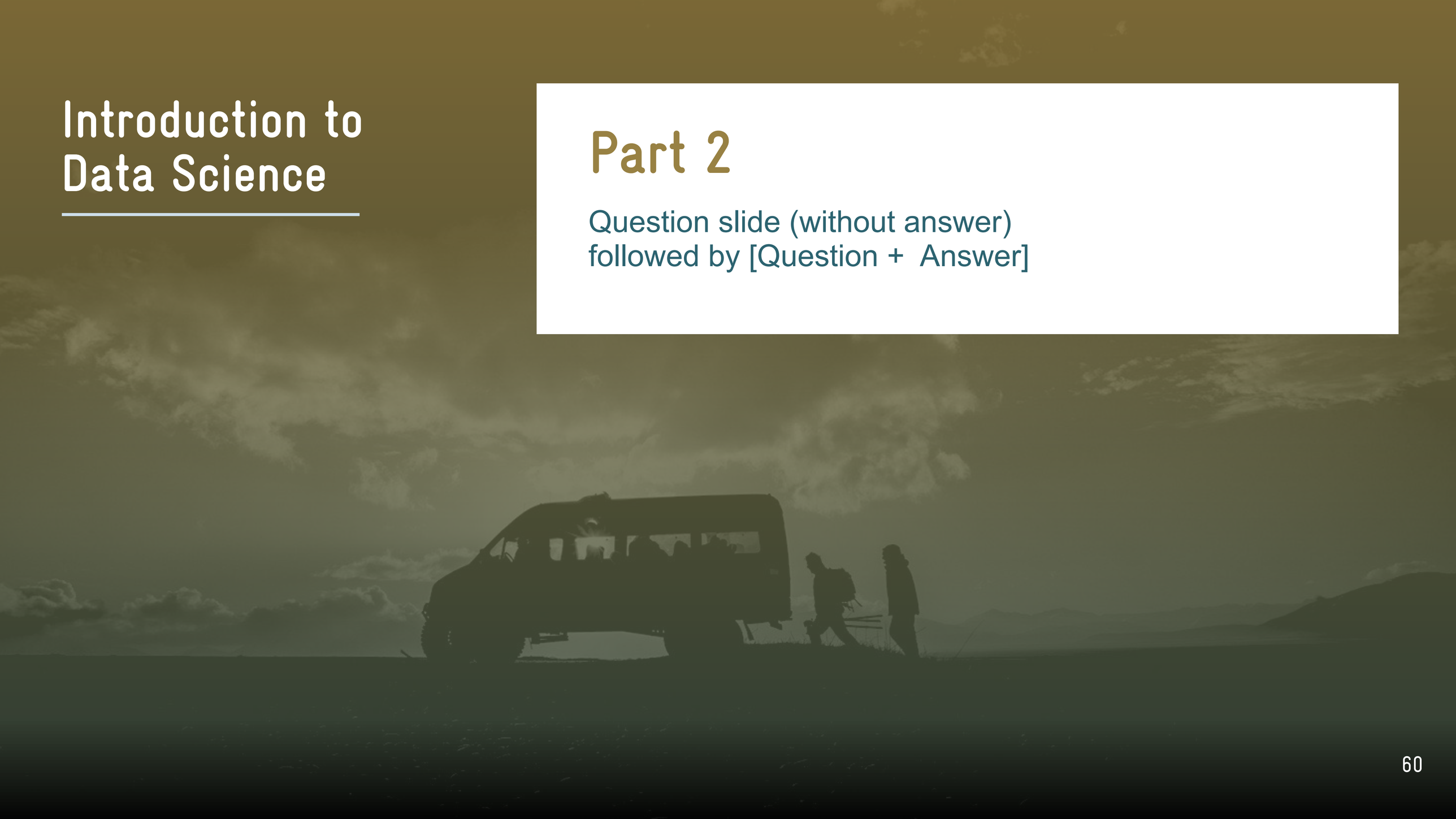

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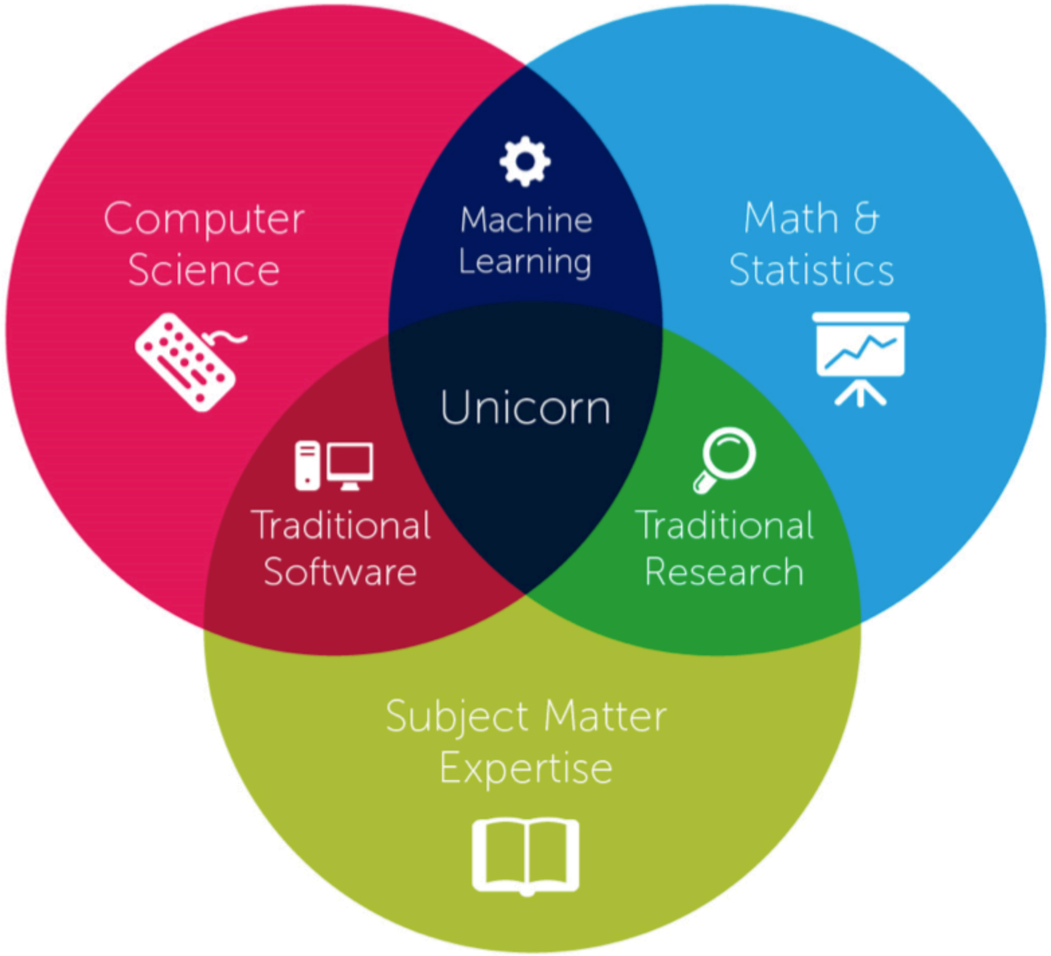

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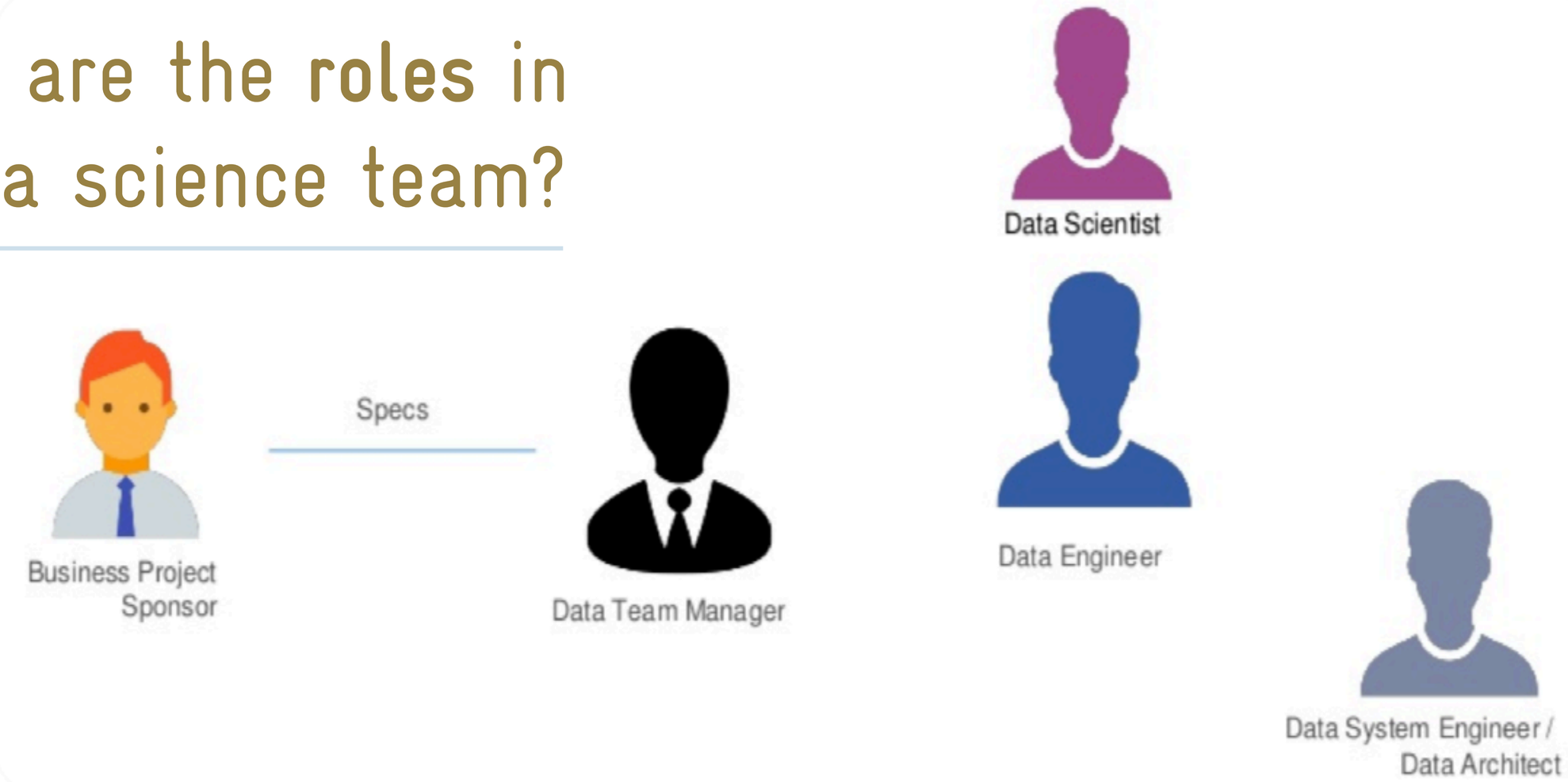

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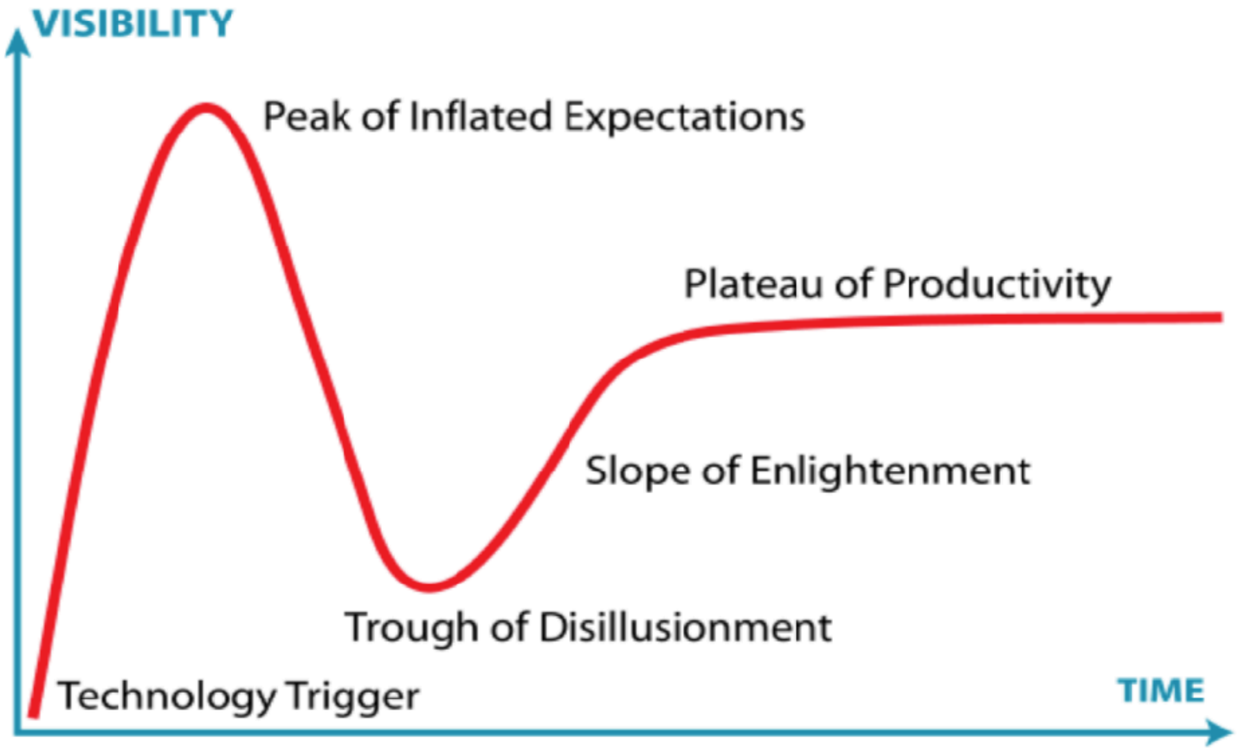

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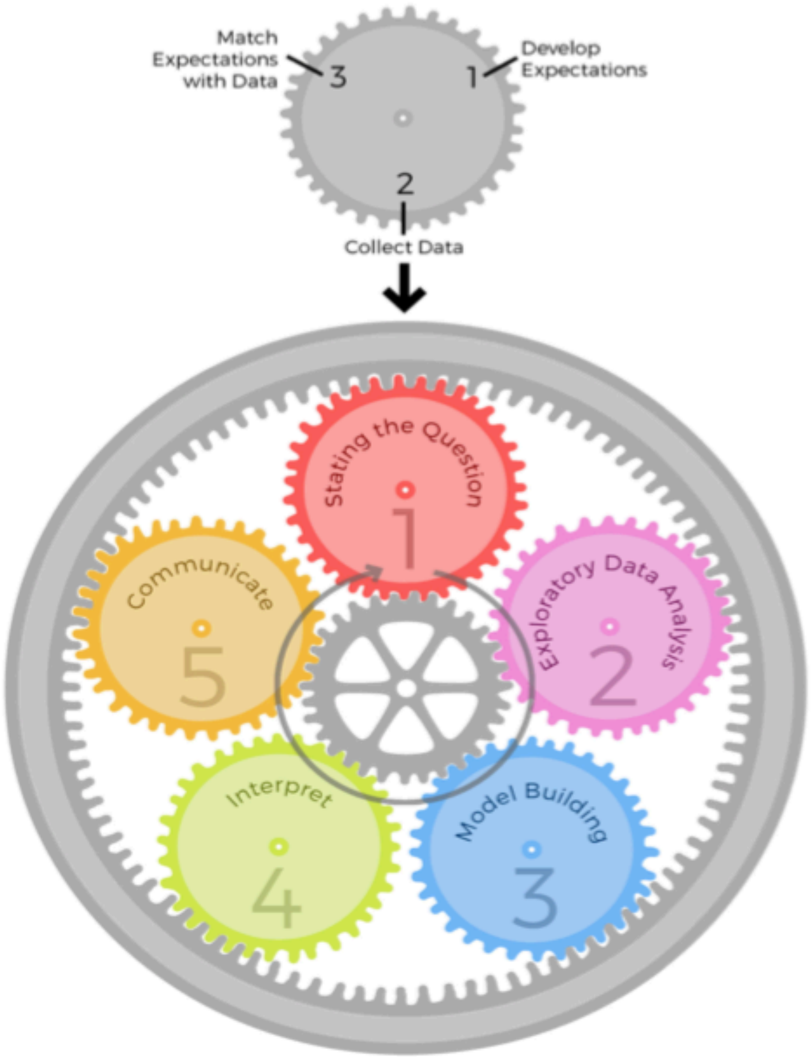
4. **Interpreting** the results
5. **Communicating** the results



Question 33:
What is Map-Reduce?

Question 33:
What is Map-Reduce?

A **parallel computing programming** paradigm developed at Google used to **preprocess** and **analyse** web pages.

Question 34:
What is Hadoop?

Question 34:
What is Hadoop?

An open-source **distributed big data file system** by Google File System

and implemented at Yahoo!

Question 35:
What is Spark?

Question 35:
What is Spark?

A new generation of **distributed big data processing system** that is **~10x faster** than MapReduce or Hadoop

Question 36:

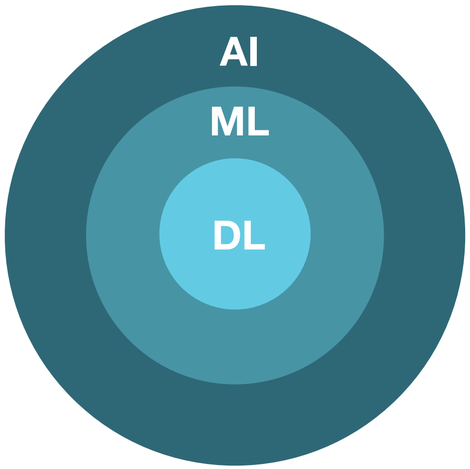
What is the difference between **Artificial Intelligence**, **Machine Learning** and **Deep Learning**?

Question 36:

What is the difference between Artificial Intelligence, Machine Learning and Deep Learning?

At the highest level, Machine Learning (ML) is a **subset** of Artificial Intelligence (AI).

In the same way, Deep Learning (DL) is a **subset** of Machine Learning.



Exists since: AI (1950), ML (1980), DL (2010)

Essence: Solve problems humans are typically better at (AI),

learn from data to make predictions (ML), mimic the human brain (DL).

Question 37:

Which are the types of Machine Learning?

Question 37:

Which are the types of Machine Learning?

There are two types of Machine Learning algorithms:

- **Supervised Learning** (*computer learns from examples*) which can be divided into:
  - Classification (*categorical target variable*)
  - Regression (*numerical target variable*)
- **Unsupervised Learning** *(computer learns the structure of the data / identifies clusters)*

Question 38:

Which are the **inputs** of a **Machine Learning algorithm**?

Question 38:

Which are the **inputs** of a **Machine Learning algorithm**?

Inputs to ML-algorithms are **features** (i.e. the columns in a dataset).

- **Numeric format** (e.g. dates, income)
- **Signal processing** (sound/image input)
- **(Text) probability and statistics:**
  (word frequency, co-occurrences = which words are grouped together)

Question 39:

Why ensemble learning works?

Question 39:

Why ensemble learning works?

By **combining** the predictions of multiple classifiers (i.e. ensembles) the **error term** of the prediction is **reduced** significantly.

Question 40:

What are the **trade-offs** in machine learning?

Question 40:

What are the **trade-offs** in machine learning?

There are five trade-off in machine learning:

1. **Interpretability** (e.g. Decision Tree vs Random Forest)
2. **Fast** (training and testing times)
3. **Accurate** predictions
4. **Simple** to understand models (e.g. Linear Regression vs Deep Learning)
5. **Scalable** (for large data-sets)

Question 41:
Why are features important?

Question 41:
Why are features important?

In a way features are the **building blocks** for any machine learning algorithm.

Using **linear algebra** features are used to fit a model to the data.

Question 42:

How can we make data **linearly separable** using **SVM**?

Question 42:

How can we make data linearly separable using SVM?

By applying the **Kernsel Density trick** (i.e. mapping data to a higher dimension)

Question 43:

Can you mention 3 good points of **traditional statistical analyses**?

Question 43:

Can you mention 3 good points of traditional statistical analyses?

1. The **parameters** of a statistical model can be easily **interpreted**
2. Statistical models are **easy** to **understand**.
3. Findings can be generalised over a **population** rather than a **sample**.

Question 44:

Can you mention 3 good points of Machine Learning?

Question 44:

Can you mention 3 good points of Machine Learning?

1. It oftentimes leads to a **higher performance** than statistical models.
2. More **accurate** and **informative** alternative on **small data** sets
3. It can also be used for **large** and **complex** datasets

Question 45:

Which are the questions you should ask for creating a **business case**?

Question 45:

Which are the questions you should ask for creating a **business case**?

1. What is you **goal**?
2. **What** is **stopping you** from reaching that goal?
3. **How much change** is needed to overcome the problem?
4. Are you **certain** this will **solve** the **problem**?

Question 46:

Which are the **3 components** of **persuasion** and their meaning?

Question 46:

Which are the 3 components of persuasion and their meaning?

1. **Logos =** the ideas make sense from the audience's point of view
2. **Ethos =** your reputation/credibility; what are you known for?
3. **Pathos =** emotional connection (e.g. by telling a personal story)

Source: https://www.youtube.com/watch?v=O2dEuMFR8kw (02:07)

Question 47:

Can you mention **5** out of **10** points to make **better presentations**?

Question 47:

Can you mention 5 out of 10 points to make better presentations?

1. **Turn off the computer/technology** (great ideas don't come from the computer)
2. **Put the audience first** (make them care emotionally, intellectually, aesthetically)
3. **Have a solid structure** (ideal > reality > problem > solution > next step)
4. **Remove the nonessential** (everything has a reason)
5. **Hook them early** (just get started, no formalities in advance)

Source: https://www.youtube.com/watch?v=YbV3b-I1sZs

Question 48:

What is the **mission** of start-up **Connecterra**?

Question 48:

What is the **mission** of start-up **Connecterra**?

“**Connecting the analogue to understand everything on earth”** (by applying AI/ML/Data Science) Ida, one of their products, is a dairy farmer’s assistant that provides meaningful insights to farmers based on cows behaviour (eating, walking, standing).

Question 49:

What is the **business-model** of the start-up **Connecterra**?

Question 49:

What is the **business-model** of the start-up **Connecterra**?

Their service to farmers is on a **subscription basis**: €7,50 per cow / month.

Question 50:

Which are the **opportunities** for Data Science in **insurance**?

Question 50:

Which are the **opportunities** for Data Science in **insurance**?

The biggest opportunity is in insurance **claims** (risk based pricing / fraud detection).

Other opportunities are in **marketing** (e.g. churn), reducing **overhead** and optimising their profit **margin**.

Question 51:

How do Data Scientists at ABN Amro reduce the **variance** of **churn prediction** models?

Question 51:

How do Data Scientists at ABN Amro reduce the **variance** of **churn prediction** models?

They make use of **ensemble models** such as Random Forest. The basic idea there is that you train a classifier on **multiple random samples** of the data based on a random subset of features for each iteration.

Question 52:

What **train flow** do Data Scientists at Rabobank use?

Question 52:

What **train flow** do Data Scientists at Rabobank use?

They use a rather standard data science approach:
Select features from historic data, **prepare** the **data** (dummies for categorical variables, imputation for NAs, scaling for better performance, add interactions), **build** a **ML-model** using the H2O package, **validate** hypotheses with a statistical **test** and eventually evaluate the **model performance**.

Question 53:

Can you mention 2 **examples** of **personalisation**?

Question 53:

Can you mention 2 **examples** of **personalisation**?

Netflix’s movie recommendation system, chatbots, Google searches, your Facebook feed, Amazon’s product recommendations, Spotify’s Discovery Weekly playlist, and many more…

Question 54:

Which are **common features** to detect **stress**?

Question 54:

Which are **common features** to detect **stress**?

Common features to detect stress are: **heart rate** (variability), **skin conductance level** and **respiration rate**.

Question 55:

Which are typical data sources used to rank hotels?

Question 55:

Which are typical data sources used to rank hotels?

Trivago uses the following data sources to rank hotels:

- **Hotel** meta-data (location)
- **Ratings** (star rating, cleanliness, breakfast, etc.)
- **Facilities** (laundry, room service, pool, etc.)
- **Images** (hotel / surroundings)
- **Personal click behaviour** (how the user interacted on the site)

One more thing...

That was it!

In other words, time to showcase your memorisation **super powers** (or just insert these (171!) slides as back-up slides..)

Anyhow, good luck! 🌟