# Propositional Logic - Truth Tables

Exercises

# Write Down the Following Argument:

**Ducks have webbed feet**

**Ducks have feathers**

**Therefore, ducks have webbed feet and ducks have feathers**

# Question #1(a): What type of argument is it?

**Ducks have webbed feet**

**Ducks have feathers**

**Therefore, ducks have webbed feet and ducks have feathers**

# Question #1(a): What type of argument is it?

**Ducks have webbed feet**

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**Therefore, ducks have webbed feet and ducks have feathers**

- Conjunctive Argument

# Question #1(b): What is the "form" of the argument using claim variables?

**Ducks have webbed feet**

**Ducks have feathers**

**Therefore, ducks have webbed feet and ducks have feathers**

# Question #1(b): What is the "form" of the argument using claim variables?

**Ducks have webbed feet**

**Ducks have feathers**

**Therefore, ducks have webbed feet and ducks have feathers**

---

- p
- q
- Therefore, p & q

# Question #1(c): Create a truth table to check for validity

**Ducks have webbed feet**

**Ducks have feathers**

**Therefore, ducks have webbed feet and ducks have feathers**

---

# Question #1(c): Create a truth table to check for validity

**Ducks have webbed feet**
**Ducks have feathers**
**Therefore, ducks have webbed feet and ducks have feathers**

---

| p | q | p & q |
|---|---|---|
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | F |

# Question #1(c): Complete Truth Table

**Ducks have webbed feet**
**Ducks have feathers**
**Therefore, ducks have webbed feet and ducks have feathers**

---

| p | q | p | q | p & q |
|---|---|---|---|---|
| T | T | T | T | T |
| T | F | T | T | F |
| F | T | F | F | F |
| F | F | F | F | F |

We can see we do not need the 2nd p, q Columns.

They just repeat the “guide columns.”

# #2: Write Down the Following Argument:

**If it is a cat, then it is furry**

**It is not a cat**

**Therefore, it is not furry**

# #2(a): What Is the Symbolic Form?

**If it is a cat, then it is furry**

**It is not a cat**

**Therefore, it is not furry**

**----------**

# #2(a): What Is the Symbolic Form?

**If it is a cat, then it is furry**

**It is not a cat**

**Therefore, it is not furry**

**----------**

$p \rightarrow q$

$\sim p$ Conditional Argument ($\rightarrow$)

Th: $\sim q$

# #2(b): Give a Truth Table to Check For Validity:

**If it is a cat, then it is furry**

**It is not a cat**

**Therefore, it is not furry**

**----------**

$p \rightarrow q$

$\sim p$

Th: $\sim q$

**Note: Remember, you will need guide columns and a column for "each" premise.**

# #2(b): Give a Truth Table to Check For Validity:

**If it is a cat, then it is furry**
**It is not a cat**
**Therefore, it is not furry**
**----------**

$p \rightarrow q$
$\sim p$
Th: $\sim q$

| p | q | $p \rightarrow q$ | $\sim p$ | $\sim q$ |
|---|---|---|---|---|
| T | T | T | F | F |
| T | F | F | F | T |
| F | T | T | T | F |
| F | F | T | T | T |

# #3(a): What type of argument is the following?:

**Either we fight for freedom or we give into tyranny.**

**We won't fight for freedom**

**Therefore, we will give into tyranny.**

**----------**

# #3(a): What Type of Argument is the Following?:

**Either we fight for freedom or we give into tyranny.**

**We won't fight for freedom**

**Therefore, we will give into tyranny.**

**----------**

**Disjunctive Argument (Or - in this case either or - which is how we will often see the disjunctive argument)**

# #3(b): Write Out the Symbolic Form:

**Either we fight for freedom or we give into tyranny.**
**We won't fight for freedom**
**Therefore, we will give into tyranny.**
**----------**

# #3(b): Write Out the Symbolic Form:

**Either we fight for freedom or we give into tyranny.**
**We won't fight for freedom**
**Therefore, we will give into tyranny.**
**----------**

p v q

~ p

Th: q

# #3(c): Write Out A Truth Table:

**Either we fight for freedom or we give into tyranny.**
**We won't fight for freedom**
**Therefore, we will give into tyranny.**

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p v q
~ p
Th: q

| p | q | p v q | ~ p | q |
|---|---|---|---|---|
| T | T | T | F | T |
| T | F | T | F | F |
| F | T | T | T | T |
| F | F | F | T | F |

# #4: Write Down the Following Argument:

**If it is Monday, then class will be held.**

**It is Monday.**

**Therefore, class will be held.**

# #4: Write Down the Following Argument:

**If it is Monday, then class will be held.**

**It is Monday.**

**Therefore, class will be held.**

A) Type of argument

B) Symbolic form of the argument

C) What is the truth table

D) Valid or Invalid argument form

# #4(a,b,c): Answer the Following Questions:

**If it is Monday, then class will be held.**
**It is Monday.**
**Therefore, class will be held.**

---

A) Type of argument

- Conditional (Modus Ponens)

# #4(a,b,c): Answer the Following Questions:

**If it is Monday, then class will be held.**
**It is Monday.**
**Therefore, class will be held.**

---

B) Symbolic Form

$p \rightarrow q$

$p$

Th: $q$

# #4(a,b,c): Answer the Following Questions:

**If it is Monday, then class will be held.**
**It is Monday.**
**Therefore, class will be held.**

---

C) Truth Table

| p | q | p → q | p | q |
|---|---|---|---|---|
| T | T | **T** | **T** | **T** |
| T | F | F | T | F |
| F | T | T | F | T |
| F | F | T | F | F |

# #4(a,b,c): Answer the Following Questions:

If it is Monday, then class will be held.

It is Monday.

Therefore, class will be held.

---

D) Valid or Invalid?

- Question: Are there any instances where both premises are true and the conclusion is false?

# #4(a,b,c): Answer the Following Questions:

If it is Monday, then class will be held.

It is Monday.

Therefore, class will be held.

---

D) Valid or Invalid?

- Question: Are there any instances where both premises are true and the conclusion is false?
- No -- So the argument is VALID
- **Modus Ponens**

# #5: Write Down the Following Argument

If it is Monday, then class will be canceled.

It is not Monday.

Therefore, class will not be canceled.

# #5(a): Write Down the Following Argument

If it is Monday, then class will be canceled.

It is not Monday.

Therefore, class will not be canceled.

- Give a truth table and tell me if the argument is valid or invalid.

# #5(a): Write Down the Following Argument

If it is Monday, then class will be canceled.

It is not Monday.

Therefore, class will not be canceled.

---

| p | q | p → q | ~ p | ~ q |
|---|---|---|---|---|
| T | T | T | F | F |
| T | F | F | F | T |
| F | T | **T** | **T** | **F** |
| F | F | T | T | T |

Invalid Form: <u>Denying the Antecedent</u> (Rows 3 is T,T F)

# #6: The following is what we call a “hypothetical syllogism”

$p \rightarrow q$

$q \rightarrow r$

$\therefore\ p \rightarrow r$

- Notice that there are three terms: p, q, r
- As a result, the guide columns in our argument get a little more complicated

# #6: “Hypothetical Syllogism”

$p \rightarrow q$

$q \rightarrow r$

$\therefore\ p \rightarrow r$

| p | q | r | p→q | q→r | p→r |
|---|---|---|---|---|---|
| T | T | T | | | |
| T | T | F | | | |
| T | F | T | | | |
| T | F | F | | | |
| F | T | T | | | |
| F | T | F | | | |
| F | F | T | | | |
| F | F | F | | | |

# #6: “Hypothetical Syllogism”

$p \rightarrow q$

$q \rightarrow r$

$\therefore\ p \rightarrow r$

| p | q | r | $p \rightarrow q$ | $q \rightarrow r$ | $p \rightarrow r$ |
|---|---|---|---|---|---|
| T | T | T | **T** | **T** | **T** |
| T | T | F | T | F | F |
| T | F | T | F | T | T |
| T | F | F | F | T | F |
| F | T | T | **T** | **T** | **T** |
| F | T | F | T | F | T |
| F | F | T | **T** | **T** | **T** |
| F | F | F | **T** | **T** | **T** |

# What about the following claim?

$$p \rightarrow (q \vee \sim q)$$

- Is this claim valid?
- Use a truth table

# And …

$$(p \,\&\, (p \rightarrow q)) \rightarrow q$$

Create a truth table to determine the value