Excel Data Types

- Excel has several types of data
  - **Numeric**: 123.45 $1234.45
  - **Text**: “Sales for 2012”
  - **Date**: 12/20/1993
  - To these we add **Logical**: TRUE and FALSE
The only values for the Logical data type are TRUE and FALSE. These correspond to the 1’s and 0’s that computers work on. TRUE and FALSE are actual values like 1 and 2. They are not text. They are never in quotes. Don’t type “TRUE”, just type TRUE.

Logical data occurs mostly as the result of asking yes/no questions that compare one value to another.

- Are sales this year higher than last year?
- Is Judi 21 or older?
- Is the interest rate more than 3.5%?
There’s only six ways to ask a yes/no question

- Expressed as the six logical operators

<table>
<thead>
<tr>
<th>Equal</th>
<th>Not Equal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Than</td>
<td>Less Than</td>
</tr>
<tr>
<td>Greater Than or Equal</td>
<td>Less Than or Equal</td>
</tr>
</tbody>
</table>
Logical Operators

- There are six operators =, <>, >, <, >=, <=
- Logical operators are the way you frame yes/no questions

<table>
<thead>
<tr>
<th>Operator</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Logical Result</th>
<th>English Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>1</td>
<td>6</td>
<td></td>
<td>Is 1 equal to 6?</td>
</tr>
<tr>
<td>Not Equal</td>
<td>2</td>
<td>5</td>
<td></td>
<td>Is 2 not equal to 5?</td>
</tr>
<tr>
<td>Greater Than</td>
<td>3</td>
<td>4</td>
<td></td>
<td>Is 3 greater than 4?</td>
</tr>
<tr>
<td>Less Than</td>
<td>4</td>
<td>3</td>
<td></td>
<td>Is 4 less than 3?</td>
</tr>
<tr>
<td>GT or Equal</td>
<td>5</td>
<td>2</td>
<td></td>
<td>Is 5 greater than or equal to 2?</td>
</tr>
<tr>
<td>LT or Equal</td>
<td>6</td>
<td>1</td>
<td></td>
<td>Is 6 less than or equal to 1?</td>
</tr>
</tbody>
</table>

A Logical Expression

- The formula =D17=E17 is a logical formula
- The operator “=“ compares the two values
- “=“ plays a role like the addition operator “+” which adds the two values
- Logical operators **always** result in the values TRUE or FALSE
Applying – Logical Expressions

- Asks the logical question: *Is the work order’s actual hours larger than its estimated hours?*

- Create a formula that results in TRUE if the Actual hours exceeds the Estimated hours. Otherwise results in FALSE

Logical Functions

- Excel has several logical functions

- These combine TRUE and FALSE values and return TRUE or FALSE

- The logical functions allow you to process more complex questions.
The OR() function

- The OR function combines several logical values and returns TRUE if ANY of them are TRUE.

The OR Truth Table

<table>
<thead>
<tr>
<th>Value 1</th>
<th>Value 2</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>FALSE</td>
<td>FALSE</td>
<td>FALSE</td>
</tr>
<tr>
<td>TRUE</td>
<td>FALSE</td>
<td>TRUE</td>
</tr>
<tr>
<td>FALSE</td>
<td>TRUE</td>
<td>TRUE</td>
</tr>
<tr>
<td>TRUE</td>
<td>TRUE</td>
<td>TRUE</td>
</tr>
</tbody>
</table>

Example – OR Question

- The question
  - Is the work order either Priority A or B?

- Write a formula that uses OR to answer the question.
OR keywords

- In English these words usually indicate you need to use the OR function
  - **Or** – Is the Priority A or B?
  - **Any** – Have any of our sales reps exceeded quota?
  - **Some** – Have some of our sales reps exceeded quota?
  - **Either** – Is either machine available for production?

The AND() function

- The AND function takes combines logical values and returns TRUE if **ALL** of them are TRUE.

AND Truth Table

<table>
<thead>
<tr>
<th>Value 1</th>
<th>Value 2</th>
<th>AND of Value 1 and Value 2</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>FALSE</td>
<td>FALSE</td>
<td>=AND(B25,C25)</td>
<td>FALSE</td>
</tr>
<tr>
<td>TRUE</td>
<td>FALSE</td>
<td>=AND(B26,C26)</td>
<td>FALSE</td>
</tr>
<tr>
<td>FALSE</td>
<td>TRUE</td>
<td>=AND(B27,C27)</td>
<td>FALSE</td>
</tr>
<tr>
<td>TRUE</td>
<td>TRUE</td>
<td>=AND(B28,C28)</td>
<td>TRUE</td>
</tr>
</tbody>
</table>
Example – AND question

- The question
  - *Is the work order’s Priority B and Actual Hours more than 30?*
  - Use the AND function to answer the question

AND keywords

- In English these words usually indicate you need to use the AND function
  - *And* – Is the work order’s Priority A and it hours over 30?
  - *All* – Are all sales rep over quota?
Combining AND and OR

- The question
  - *Is a Work Order’s Estimated Hours between 10 and 20 and it’s Priority either A or B?*

- Need to combine the AND and OR functions to answer the question

- Tip: Build the expression step by step. Start out simple and test the expression as you add to it.

TIP: Start simple and build up

- Build your formula up step by step

- Check the result at each step and make sure it’s working before going on to the next step.

- Writing out a complete complex formula in full will almost always take longer then working step-wize.
TIP: Start simple and build up

- \( =C2 = "A" \)
- \( =OR(C2 = "A") \)
- \( =OR(C2 = "A", C2 = "B") \)
- \( =AND(OR(C2 = "A", C2 = "B")) \)
- \( =AND(D2 >= 10, OR(C2 = "A", C2 = "B"))) \)
- \( =AND(D2 >= 10, D2 <= 20, OR(C2 = "A", C2 = "B")) \)

The IF() function

- The IF function asks a logical question and returns one value if the answer is TRUE and another if the answer is FALSE.
- Very useful for translating TRUE or FALSE into something easier to grasp.
**The IF() Function**

- **Question:** *Is the Actual hours more than 40?*

- This is a simple logical question, but it’s real meaning is whether the work order resulted in overtime (more than 40 hours)

- Instead of TRUE or FALSE, use the IF function to display "Overtime" when Actual Hours exceeds 40 otherwise display "Regular"
Logical Operations Summary

- Only two values: TRUE and FALSE
  - These are not text.

- There are six relational operators.

- Note: Figure out the NOT() function on your own.