

# Introduction to Computers Lab

## First Year (2017 – 2018)



Lab 5

# The Decimal Number System

- ❖ Name : “**decimal** ” base-10 system, short name “**dec**”
- ❖ Characteristics : Ten symbols
  - **0 1 2 3 4 5 6 7 8 9**
  - **$2945 = (2*10^3) + (9*10^2) + (4*10^1) + (5*10^0)$**
- ❖ For an n-digit number, the value that each digit represents depends on its weight or position.
- ❖ The weights are based on powers of 10
  - **$1024 = 1*10^3 + 0*10^2 + 2*10^1 + 4*10^0 = 1000 + 20 + 4$**

| <b>4<sup>th</sup></b>           | <b>3<sup>rd</sup></b>          | <b>2<sup>nd</sup></b>         | <b>1<sup>st</sup></b>        | <b>POSITION</b> |
|---------------------------------|--------------------------------|-------------------------------|------------------------------|-----------------|
| <b><math>10^3 = 1000</math></b> | <b><math>10^2 = 100</math></b> | <b><math>10^1 = 10</math></b> | <b><math>10^0 = 1</math></b> | <b>WEIGHT</b>   |

# The Binary Number System

- ❖ Name : “**binary** ” base-2 system, short name “**bin**”
- ❖ Characteristics : Two symbols
  - **0 1**
- ❖ Most (digital) computers use the binary number system
- ❖ Terminology
  - **Bit**: a binary digit
  - **Byte**: (typically) 8 bits
- ❖ For an n-digit number, the value of a digit in each column depends on its position.
- ❖ The weights are based on powers of 2.
  - $1011_2 = 1*2^3 + 0*2^2 + 1*2^1 + 1*2^0 = 8 + 2 + 1 = 11_{10}$

| 4 <sup>th</sup> | 3 <sup>rd</sup> | 2 <sup>nd</sup> | 1 <sup>st</sup> | Position |
|-----------------|-----------------|-----------------|-----------------|----------|
| $2^3 = 8$       | $2^2 = 4$       | $2^1 = 2$       | $2^0 = 1$       | Weight   |

# The Hexadecimal Number System

- ❖ Name : “**hexadecimal** ” base-16 system, short name “**hex**”
- ❖ Characteristics : Sixteen symbols
  - **0 1 2 3 4 5 6 7 8 9 A B C D E F**
- ❖ The letters A to F represent the unit values 10 to 15
- ❖ Computer programmers often use the hexadecimal number system
- ❖ For an n-digit number, the value of a digit in each column depends on its position.
- ❖ The weights are based on powers of 16.
  - $7D1_{16} = 7*16^2 + 13*16^1 + 1*16^0 = 1792 + 208 + 1 = 2001_{10}$
- ❖ An hex number can easily be converted to binary by replacing each Hex digit with the corresponding group of 4 binary digits.

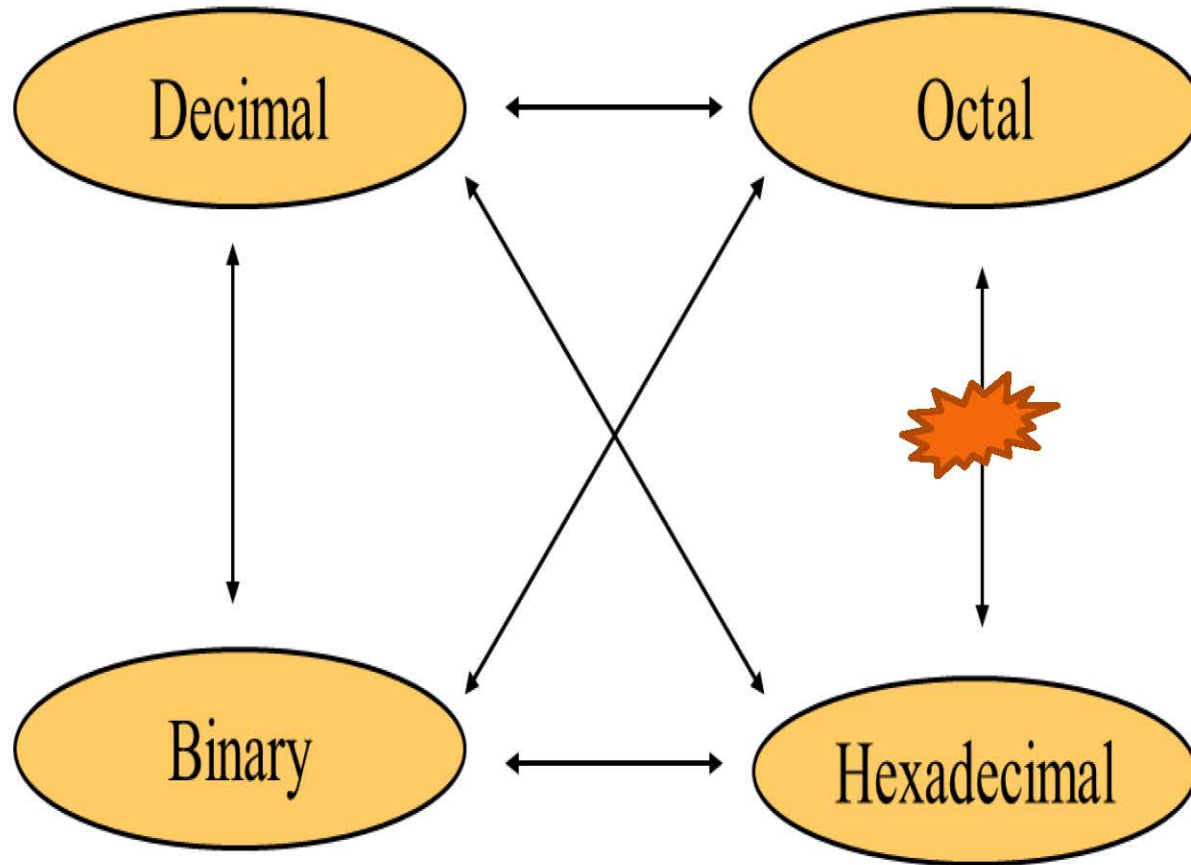
| 4 <sup>th</sup> | 3 <sup>rd</sup> | 2 <sup>nd</sup> | 1 <sup>st</sup> | POSITION |
|-----------------|-----------------|-----------------|-----------------|----------|
| $16^3 = 4096$   | $16^2 = 256$    | $16^1 = 16$     | $16^0 = 1$      | WEIGHT   |

# The Octal Number System

- ❖ Name : “**octal** ” base-8 system, short name “**oct**”
- ❖ Characteristics : Eight symbols
  - **0 1 2 3 4 5 6 7**
- ❖ For an n-digit number, the value of a digit in each column depends on its position.
- ❖ The weights are based on powers of 8.
  - $7512_8 = 7*8^3 + 5*8^2 + 1*8^1 + 2*8^0 = 3914_{10}$
- ❖ An octal number can easily be converted to binary by replacing each octal digit with the corresponding group of 3 binary digits.

| 4 <sup>th</sup> | 3 <sup>rd</sup> | 2 <sup>nd</sup> | 1 <sup>st</sup> | POSITION |
|-----------------|-----------------|-----------------|-----------------|----------|
| $8^3 = 512$     | $8^2 = 64$      | $8^1 = 8$       | $8^0 = 1$       | WEIGHT   |

# Convert a number from any base to another



# Decimal System

∞ 7 ∞

# 1-Convert to decimal

- ∞ Conversions to the decimal number system depends on the base of the number system you will convert from( i.e. 2 in case of binary,8 in case of oct and 16 in case of hex)
- ∞ The conversion equation is

$$number_b = [d_N \dots d_2 d_1 d_0]_b = \sum_{n=0}^N d_n b^n = d_0 b^0 + d_1 b^1 + d_2 b^2 + \dots + d_N b^N$$

Where

$b$  - numeral system base

$d_n$  - the  $n$ -th digit

$n$  - can start from negative number if the number has a fraction part.



# 1-Convert to decimal (cont.)

☞ Example 1: (from Bin. to decimal)

➤  $1011.101_2$

➤  $= (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) + (1 \times 2^{-1}) + (0 \times 2^{-2}) + (1 \times 2^{-3})$

$$= 8 + 0 + 2 + 1 + 0.5 + 0 + 0.125$$

$$= 11.625_{10}$$

☞ Example 2: (from Hex. To decimal)

➤  $2AF.3_{16}$

➤  $= (2 \times 16^2) + (10 \times 16^1) + (15 \times 16^0) + (3 \times 16^{-1})$

$$= 512_{10} + 160_{10} + 15_{10} + 0.1875$$

$$= 687.1875_{10}$$

# 1-Convert to decimal (cont.)

∞ Example 3: (from Oct. to decimal)

➤  $254.7_8$

➤  $= (2 \times 8^2) + (5 \times 8^1) + (4 \times 8^0) + (7 \times 8^{-1})$

➤  $= 128_{10} + 40_{10} + 4_{10} + 0.875$

➤  $= 172.875_{10}$

# 2-Convert from Decimal

- ∞ To convert any decimal number to any other number system:
1. Divide the number by base.
  2. Get the integer quotient for the next iteration.
  3. Get the remainder for the digit.
  4. Repeat the steps until the quotient is equal to 0.


# 2-Convert from Decimal


🌀 Example 1: (from decimal to binary)

🌀  $13_{10} = (\dots)_2$

🌀 Solution:

| Division by 2 | Quotient | Remainder | Bit # |
|---------------|----------|-----------|-------|
| 13/2          | 6        | 1         | 0     |
| 6/2           | 3        | 0         | 1     |
| 3/2           | 1        | 1         | 2     |
| 1/2           | 0        | 1         | 3     |



So  $13_{10} = (1101)_2$   


# 2-Convert from Decimal (cont.)

☞ Example 2: (from decimal to binary with floating point)

☞  $37.375_{10} = ???$

☞ Solution:

$37 = ???$

Repeated division

$37 / 2 = 18$  remainder 1 (binary number will end with 1)

$18 / 2 = 9$  remainder 0

$9 / 2 = 4$  remainder 1

$4 / 2 = 2$  remainder 0

$2 / 2 = 1$  remainder 0

$1 / 2 = 0$  remainder 1 (binary number will start with 1)

Read the result upward to give an answer of  $37_{10} = 100101_2$

$0.375 = ???$

Repeated multiplication

$0.375 \times 2 = 0.750$  integer 0 **MSB**

$0.750 \times 2 = 1.500$  integer 1

$0.500 \times 2 = 1.000$  integer 1 **LSB**

Read the result downward  $.375_{10} = .011_2$

So  $37.375_{10} = 100101.011_2$

# 2-Convert from Decimal (cont.)

Example 3: (from decimal to Octal):

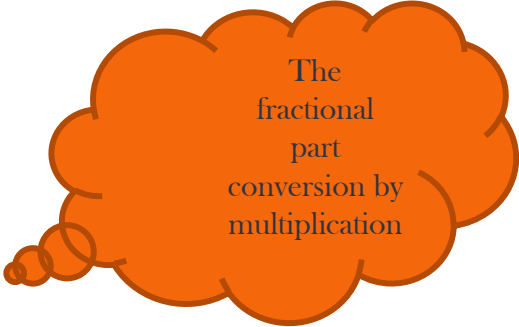
$$23.68_{10} = ???$$

Solution:

- $23_{10} = ???$
- Repeated division
- $23_{10} / 8 = 2$  remainder 7 (Octal number will end with 7) : **LSB**
- $2_{10} / 8 = 0$  remainder 2 (Octal number will start with 2) : **MSB**
- Read the result upward to give an answer of  $23_{10} = 27_8$
- $0.68_{10} = ???$
- Repeated multiplication
  - $0.68 * 8 = 5.44$  (0.44) and integer is 5 **MSB**
  - $0.44 * 8 = 3.52$  (0.52) and integer is 3
  - $0.52 * 8 = 4.16$  (0.16) and integer is 4 **LSB**
  - Read the result downward  $.68_{10} = .534_8$
- So  $23.68_{10} = 27.534_8$



The integer  
part  
conversion  
by division



The  
fractional  
part  
conversion by  
multiplication

# 2-Convert from Decimal (cont.)

☞ Example 4: (from decimal to Hex.) :

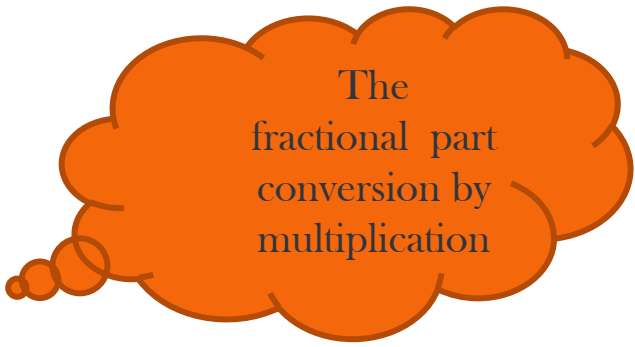
☞  $423.78_{10} = !!!$

☞ Solution:

- $423_{10} = !!!$
- **Repeated division**
- $423_{10} / 16 = 26$  remainder 7 (Hex number will end with 7) : **LSB**
- $26_{10} / 16 = 1$  remainder 10
- $1_{10} / 16 = 0$  remainder 1 (Hex number will start with 1) : **MSB**
- Read the result upward to give an answer of  $423_{10} = 1A7_{16}$
- $0.78_{10} = !!!$
- **Repeated multiplication**
  - $0.78 * 16 = 12.48$  (0.48) and integer is 12  $\rightarrow$  C **MSB**
  - $0.48 * 16 = 7.68$  (0.68) and integer is 7  $\rightarrow$  7
  - $0.68 * 16 = 10.88$  (0.88) and integer is 10  $\rightarrow$  A **LSB**
  - Read the result downward  $.78_{10} = .C7A_{16}$
- So  $423.78_{10} = 1A7.C7A_{16}$



The integer  
part  
conversion by  
division



The  
fractional part  
conversion by  
multiplication

# Binary System

∞ 16 ∞

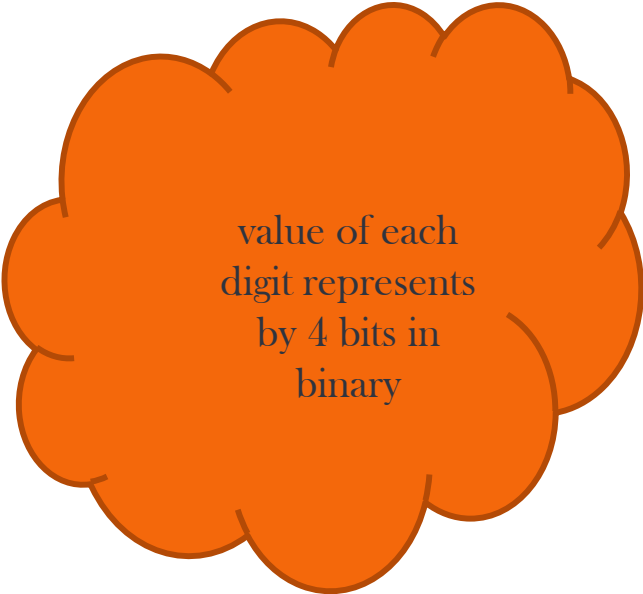


# 1-Convert to Binary System

## A. Convert From Hexadecimal to binary System:

1. Represent each digit in hexadecimal by 4 bits to find the equivalent binary number.
2. Example 1:

$$\begin{array}{ccccccc} 9 & F & 2 & 5 & & & \\ \downarrow & \downarrow & \downarrow & \downarrow & & & \\ = 1001 & 1111 & 0010 & 0101 & & & \\ = 100111110010.0101_2 & & & & & & \end{array}$$



value of each  
digit represents  
by 4 bits in  
binary

- Exercise:

1.  $8AC.2D_{16} = ???$
2.  $5FF_{16} = ???$

# 1-Convert to Binary System(cont.)

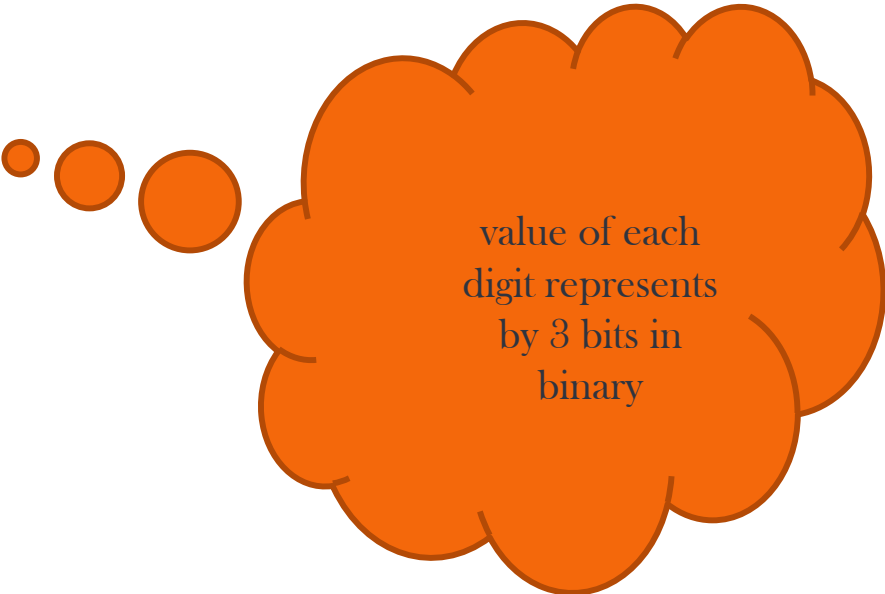
## 🔗 Convert From Octal to binary System:

- Represent each digit in Octal number by 3 bits to find the equivalent binary number.
- Example 1:

$$\begin{array}{rcccl} 72.5_8 = & 7 & 2 & 5 & \\ & \downarrow & \downarrow & \downarrow & \\ & = 111 & 010 & 101 & \\ & = 111010.101_2 & & & \end{array}$$

Excercises:

- $524.2_8 = (..) _2$
- $177_8 = (..) _2$



value of each  
digit represents  
by 3 bits in  
binary

# 2-Convert From Binary System

## Convert from binary system to Hexadecimal:

- value of each 4 digits represents by 1 digit in octal
- Start from the right before floating point
- Start from the left after floating point
- Example:

$$1110100110.011_2 = \underbrace{0011}_{3} \underbrace{1010}_{A} \underbrace{0110}_{6} . \underbrace{0110}_{6}$$
$$= 3A6.6_{16}$$

If the latest digits  
smaller than 3  
complete them by  
zero's

Excercises :

- $1001.11_2 = (\dots)_{16}$
- $11001.101_2 = (\dots)_{16}$

# 2-Convert From Binary System(cont.)

## B. Convert from Binary to Octal System:

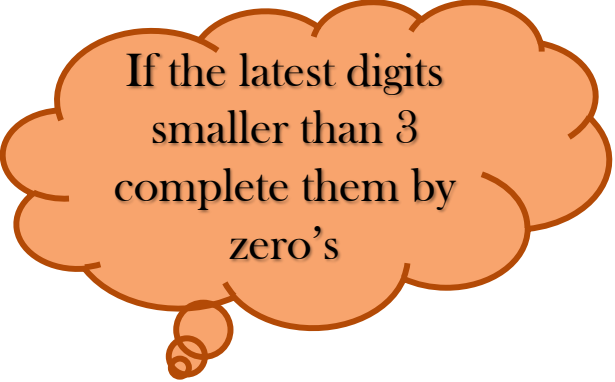
- value of each 3 digits represents by 1 digit in octal
- Start from the right before floating point
- Start from the left after floating point
- Example:

$$1100100100.001_2 = \underbrace{001}_1 \underbrace{100}_4 \underbrace{100}_4 \underbrace{100}_4 . \underbrace{001}_1$$
$$= 1444.1_8$$

Find:

1.  $1101.1001_2 = ???$

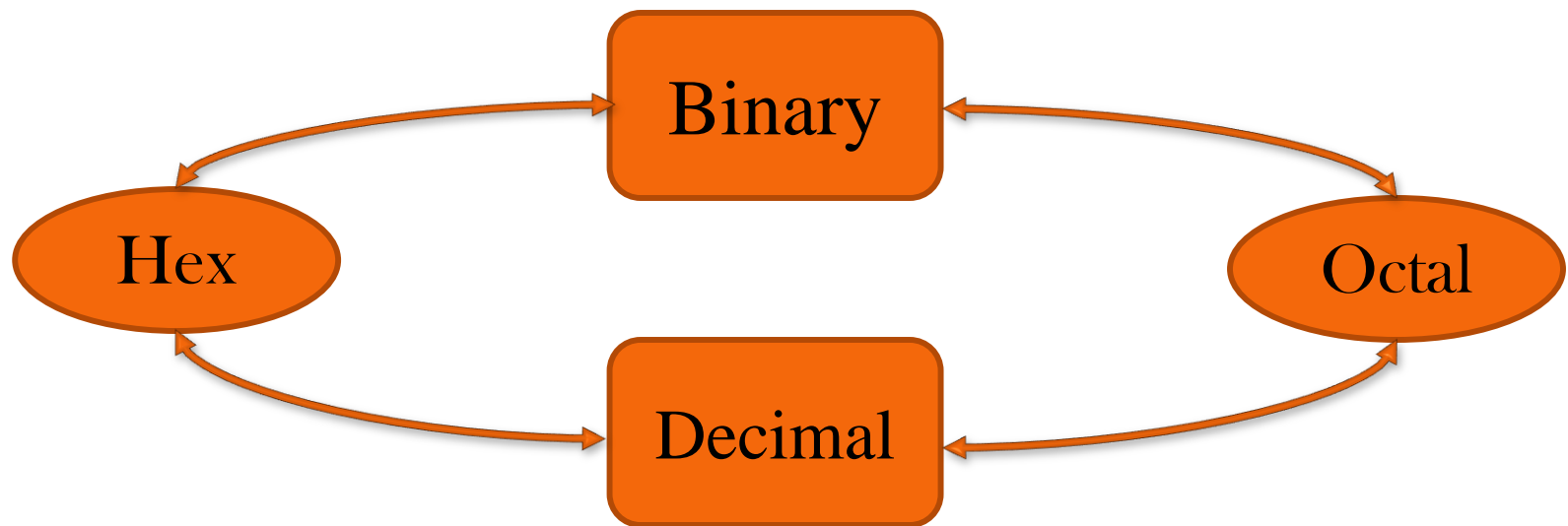
2.  $110101.101_2 = ???$



If the latest digits  
smaller than 3  
complete them by  
zero's

# Hexadecimal ↔ Octal

- ∞ Conversion from HEX to OCT and from OCT to HEX is difficult ..
- ∞ Use decimal or binary as a step between them



# Hex to Oct Conversion

☞ Example :  $A1_{16} = (..)_{8}$

☞ Solution:

☞ Using decimal

$$A1_{16} = 10 \times 16^1 + 1 \times 16^0 = 160 + 1 = 161_{10}$$

$$\rightarrow A1_{16} = 161_{10}$$

$$161_{10} / 8 = 20 \text{ remainder } 1$$

$$20_{10} / 8 = 2 \text{ remainder } 4$$

$$2_{10} / 8 = 0 \text{ remainder } 2$$

$$\rightarrow 161_{10} = 241_8$$

$$\text{So } A1_{16} = 241_8$$

☞ Using binary

$$A1_{16} = 1010 \ 0001_2$$

$$0101 \ 0000 \ 0001 \ 0001$$

# Octal to hex Conversion

☞ Example:  $71_8 = (\dots)_{16}$

☞ Solution:

☞ Using decimal

$$71_8 = 7 \times 8^1 + 1 \times 8^0 = 56 + 1 = 57_{10}$$

$$\rightarrow 71_8 = 57_{10}$$

$$57_{10} / 16 = 3 \text{ remainder } 9$$

$$3_{10} / 16 = 0 \text{ remainder } 3$$

$$\rightarrow 57_{10} = 39_{16}$$

So  $71_8 = 39_{16}$

☞ Using binary

$$71_8 = 111\ 001_2$$

$$0011\ 1001_2 = 39_{16}$$

# Exercises



# Solve

## ➤ Convert to decimal

- $11001.110_2$
- $275.6_8$
- $1AD.F_{16}$

## ➤ Convert to binary

- $235.6_{10}$
- $57.3_8$
- $1DF.3_{16}$

## ➤ Convert to hex

- $11001.1101_2$
- $275.6_8$
- $123_{10}$

## ➤ Convert to octal

- $235.6_{10}$
- $1001_2$
- $1DF.3_{16}$

# Solution

## ➤ Convert to decimal

- $11001.110_2 = 25.75$
- $275.6_8 = 189.75$
- $1AD.F_{16} = 429.9375$

## ➤ Convert to binary

- $235.6_{10}$   
 $= 11101011.1001100$   
 $110011001101$
- $57.3_8 = 101111.011$
- $1DF.3_{16}$   
 $= 111011111.0011$

## ➤ Convert to hex

- $11001.1101 = 19.D$
- $275.6_8 = BD.C$
- $123_{10} = 7B$

## ➤ Convert to octal

- $235.6_{10} = 353.4631$
- $1001_2 = 11$
- $1DF.3_{16} = 737.14$

# On Line Converter

✂ <http://www.rapidtables.com/convert/number/hex-dec-bin-converter.htm>

# Number of Bits needed to represent value

∞ How many values can be represented in  $n$  bits ??

If  $n = 5$  ...

So the rule is ( $2^n$ )

So in 5 bits we can represent  $2^5 = 32$  value (00000 to 11111) in decimal is (0 to 31).

∞ How many values can be represented in 6 bits ??

∞ How many values can be represented in 4 bits ??



# Largest & smallest number that can be represented in n digits

- What's the Largest and Smallest number that can be represented in n digits ??

If  $n = 5$  ...

So the rule of the largest value is  $(2^n - 1)$

So in 4 bits the largest value is  $2^5 - 1 = (11111)_2$  in decimal (31)

And always the Smallest value is 0

So the smallest value is  $(00000)_2$  in decimal (0)

- What's the Largest and Smallest number that can be represented in 6 digits ??
- What's the Largest and Smallest number that can be represented in 2 digits ??

# Number of bits needed to represent a certain value

∞ How many bits needed to represent x decimal value ??

If value (x) = 17 ...

the rule is  $2^{n-1} - 1 < x < 2^n - 1$

$$2^4 - 1 < 17 < 2^5 - 1$$

So the n digits can represent 17 is 5 digits  $(10001)_2$

∞ How many digits needed to represented 29 decimal value ??

∞ How many digits needed to represented 16 decimal value ??



# Exercises

➤ How many values can be represented in  $n$  bits ??

∞ When

- $n = 8$
- $n = 1$

➤ What's the Largest and Smallest number that can be represented in  $n$  digits ??

• When

- $n = 5$
- $n = 10$

➤ How many digits needed to represent  $x$  decimal value ??

• When

- $x = 52$
- $x = 100$

# Solution

✂ How many values can be represented in n bits ??

✂ When

- $n = 8$  ,  $2^8$
- $n = 1$  , 2

➤ What's the Largest and Smallest number that can represented in n digits ??

• When

➤ How many digits needed to represented x decimal value ??

• When

- x = 52 , 6bits
- x = 100 , 7bits

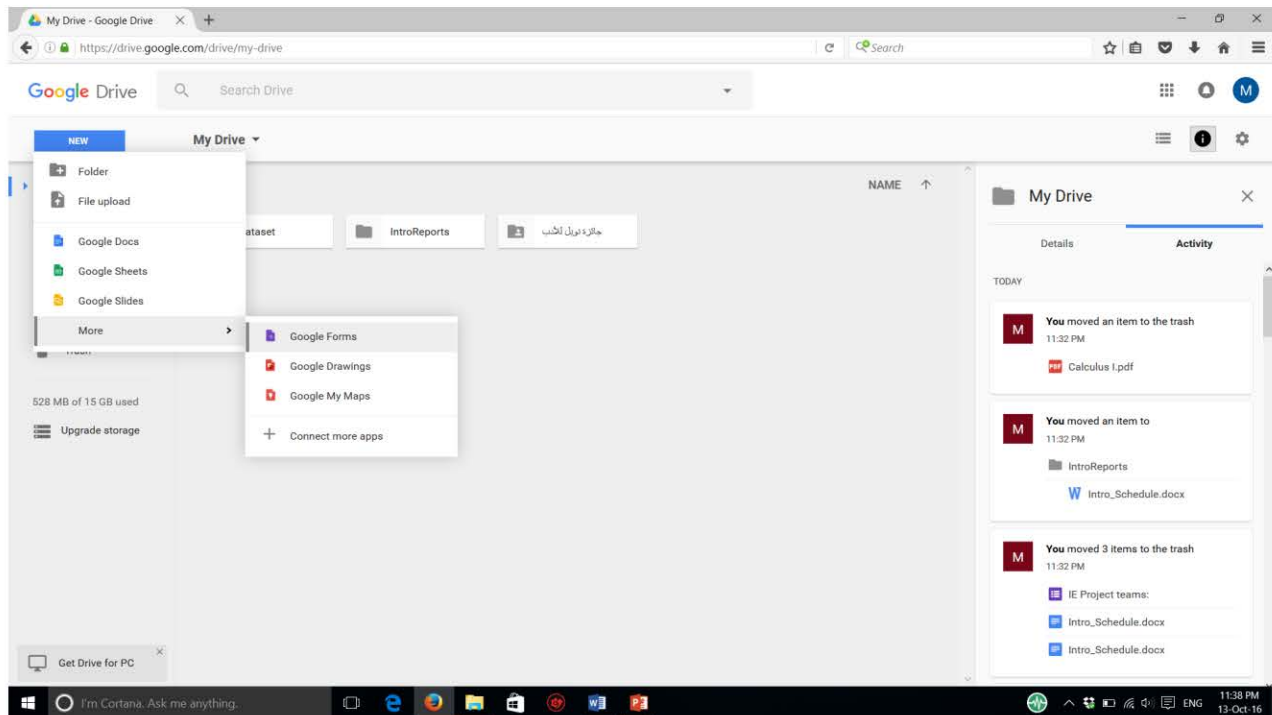


**BREAK (10 Min.)**

# Google Forms

∞ 34 ∞

# Creating Forms



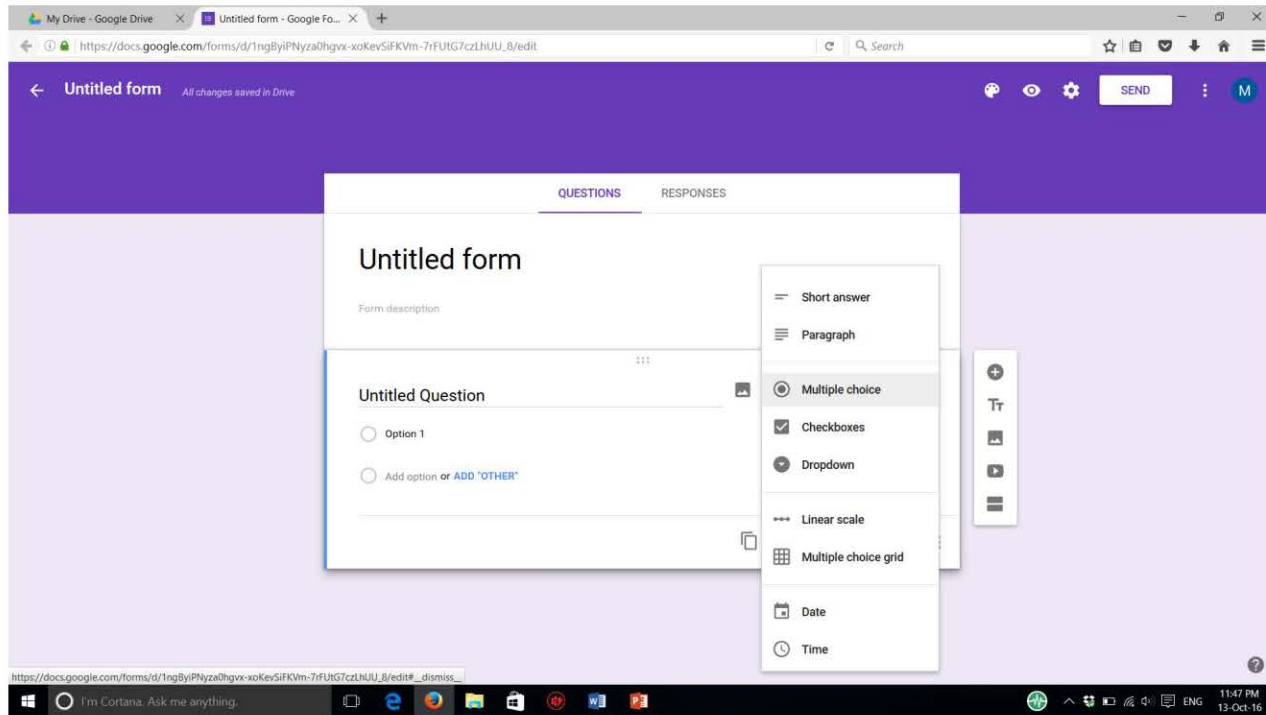
# Add and Edit Questions

The screenshot shows the Google Forms editor interface. At the top, there's a purple header with 'Untitled form' and 'All changes saved in Drive'. Below this, a white panel contains the form details. The panel has two tabs: 'QUESTIONS' and 'RESPONSES'. The 'QUESTIONS' tab is active. Inside this panel, the form title 'Untitled form' is at the top, followed by a 'Form description' field. Below the description is a question titled 'Untitled Question'. To the right of the question title is a dropdown menu showing 'Multiple choice'. Below the question title are two radio button options: 'Option 1' and 'Add option or ADD "OTHER"'. At the bottom right of the question panel is a 'Required' toggle switch. To the right of the question panel is a vertical toolbar with icons for adding different types of questions (text, multiple choice, grid, etc.).

Numbered callouts in the image:

- 1: Points to the form title 'Untitled form'.
- 2: Points to the question title 'Untitled Question'.
- 3: Points to the question type dropdown menu.
- 4: Points to the vertical toolbar on the right.
- 5: Points to the 'Required' toggle switch.

# Questions types



# Exercise

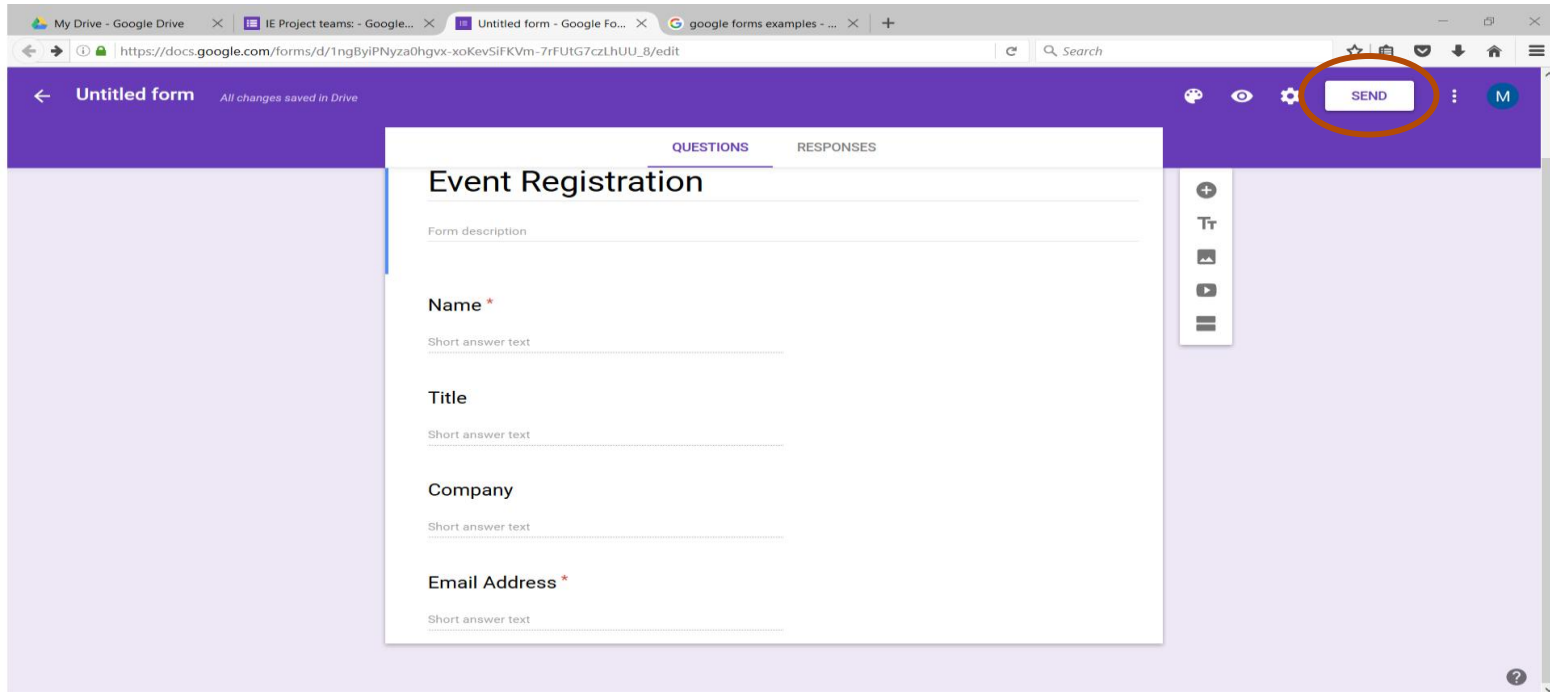
The image shows a web browser window displaying a Google Forms 'Event Registration' form. The browser's address bar shows the URL: <https://docs.google.com/forms/d/e/1FAIpQLSe82p90L7QcUjZ37zgcYM9rUxLRG889lYtqD2qioIT17v8oA/viewform?c=0&w=1>. The form has a purple header and footer. The main content area is white and contains the following fields:

- Event Registration** (Title)
- \* Required** (Red asterisk indicating required field)
- Name \*** (Text field with placeholder 'Your answer')
- Title** (Text field with placeholder 'Your answer')
- Company** (Text field with placeholder 'Your answer')
- Email Address \*** (Text field with placeholder 'Your answer')
- SUBMIT** (Blue button)

The Windows taskbar is visible at the bottom, showing the Start button, Cortana search bar, and several application icons. The system clock in the bottom right corner indicates 1:02 AM on 14-Oct-16.

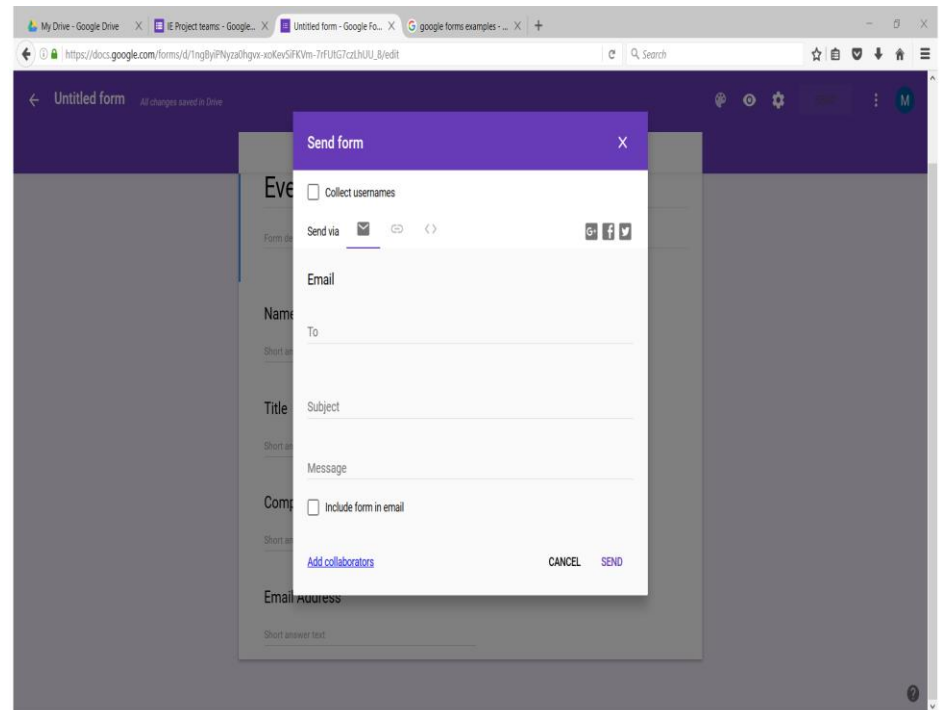
# Sharing Forms

🌀 In order to share the created form with others use **Send** button.



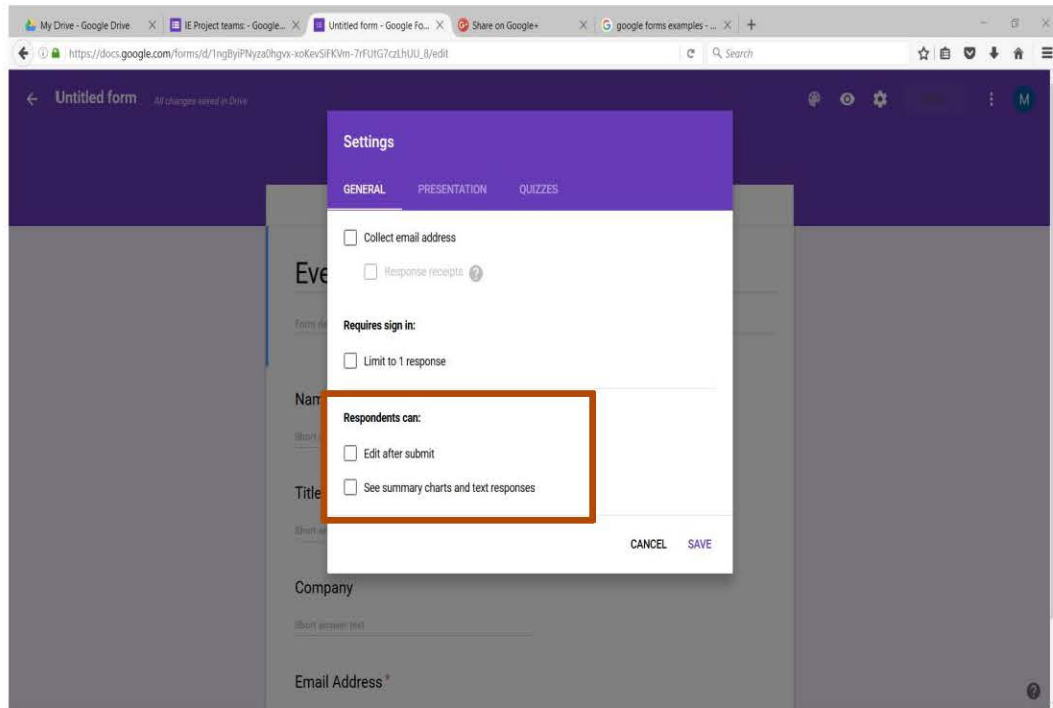
The screenshot displays the Google Forms editor interface. The top navigation bar is purple and contains a back arrow, the text 'Untitled form', and a status message 'All changes saved in Drive'. On the right side of this bar are icons for chat, preview, settings, a 'SEND' button (circled in orange), a vertical ellipsis menu, and a user profile icon. The main content area is divided into two tabs: 'QUESTIONS' (active) and 'RESPONSES'. Under the 'QUESTIONS' tab, the form is titled 'Event Registration'. Below the title is a 'Form description' field. The form contains four required text input fields: 'Name \*', 'Title', 'Company', and 'Email Address \*'. Each field is labeled 'Short answer text'. A vertical toolbar on the right side of the form area includes icons for adding new questions, changing the theme, inserting images, and inserting videos.

- ☞ You can send form using
- ☞ 1) Email
- ☞ 2) Get a sharable link
- ☞ 3) Embed link in HTML
- ☞ 4) Google +
- ☞ 5) Facebook.
- ☞ 6) Twitter





# Form Settings



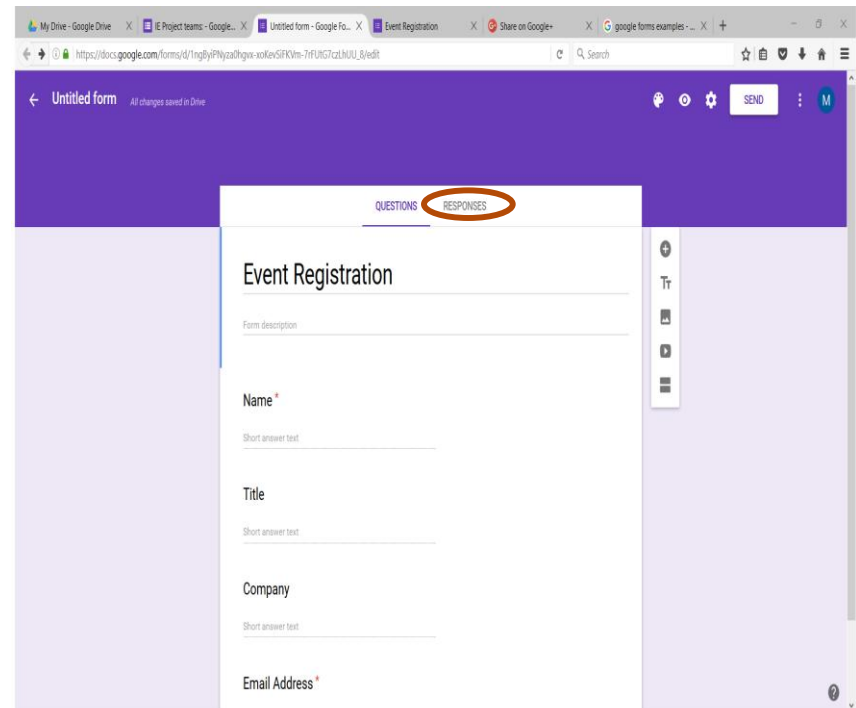
The screenshot shows a web browser window with multiple tabs. The active tab is 'Untitled form - Google Fo...', displaying a Google Forms editor. A 'Settings' dialog box is open, showing the 'GENERAL' tab. The dialog box has a purple header with the title 'Settings'. Below the header are three tabs: 'GENERAL', 'PRESENTATION', and 'QUIZZES'. The 'GENERAL' tab is selected. The settings listed are:

- ☐ Collect email address
- ☐ Response receipts
- Requires sign in:**
  - ☐ Limit to 1 response
- Respondents can:**
  - ☐ Edit after submit
  - ☐ See summary charts and text responses

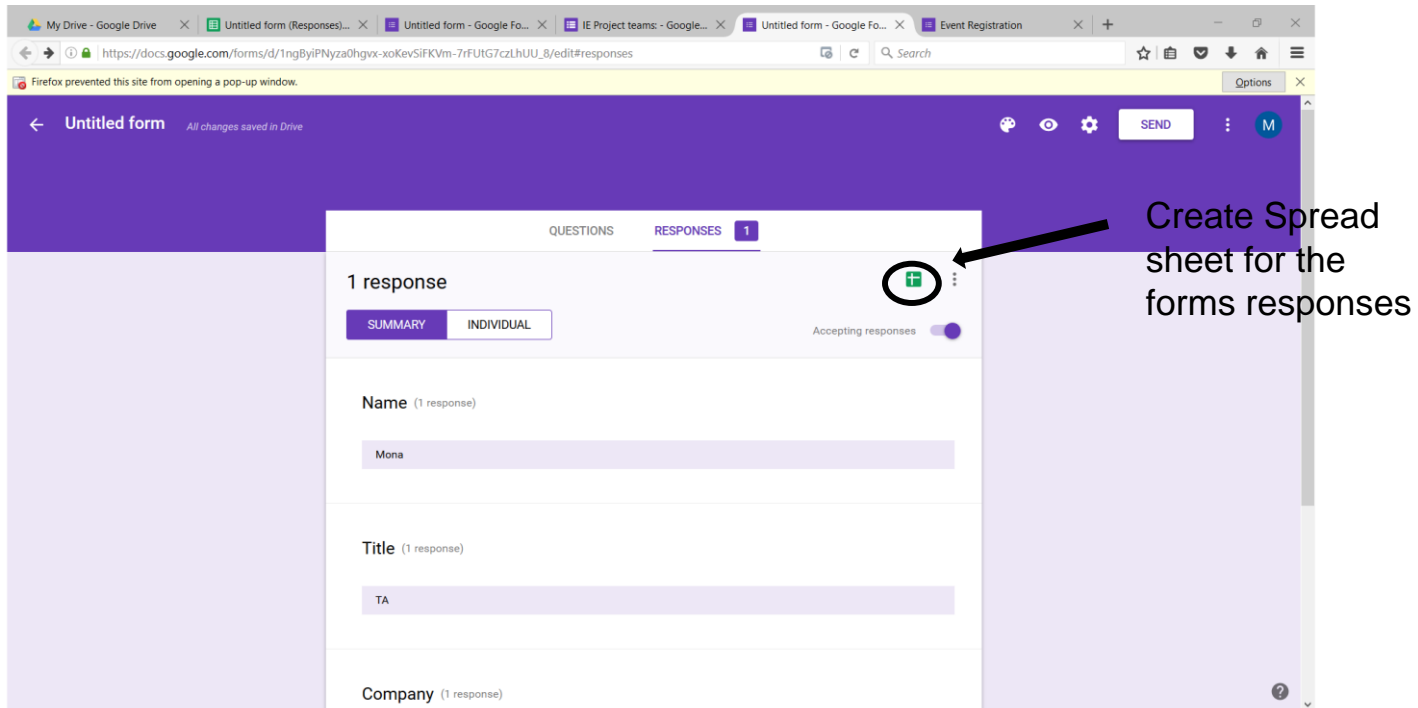
At the bottom of the dialog box are two buttons: 'CANCEL' and 'SAVE'. The background of the browser window shows a form titled 'Untitled form' with fields for 'Name', 'Title', 'Company', and 'Email Address\*'. The 'Email Address\*' field is highlighted with a red box.

# Collect Forms Responses

∞ The form creator can see the respondents' responses by pressing the **Responses** tab.



# Collect Forms Responses(cont.)



The screenshot shows the Google Forms interface in a web browser. The 'RESPONSES' tab is selected, showing '1 response'. A green spreadsheet icon is circled in the top right corner of the response list, with an arrow pointing to it from the text 'Create Spreadsheet for the forms responses'. The form fields shown are 'Name' (with value 'Mona'), 'Title' (with value 'TA'), and 'Company'.

1 response

SUMMARY INDIVIDUAL

Accepting responses

Name (1 response)

Mona

Title (1 response)

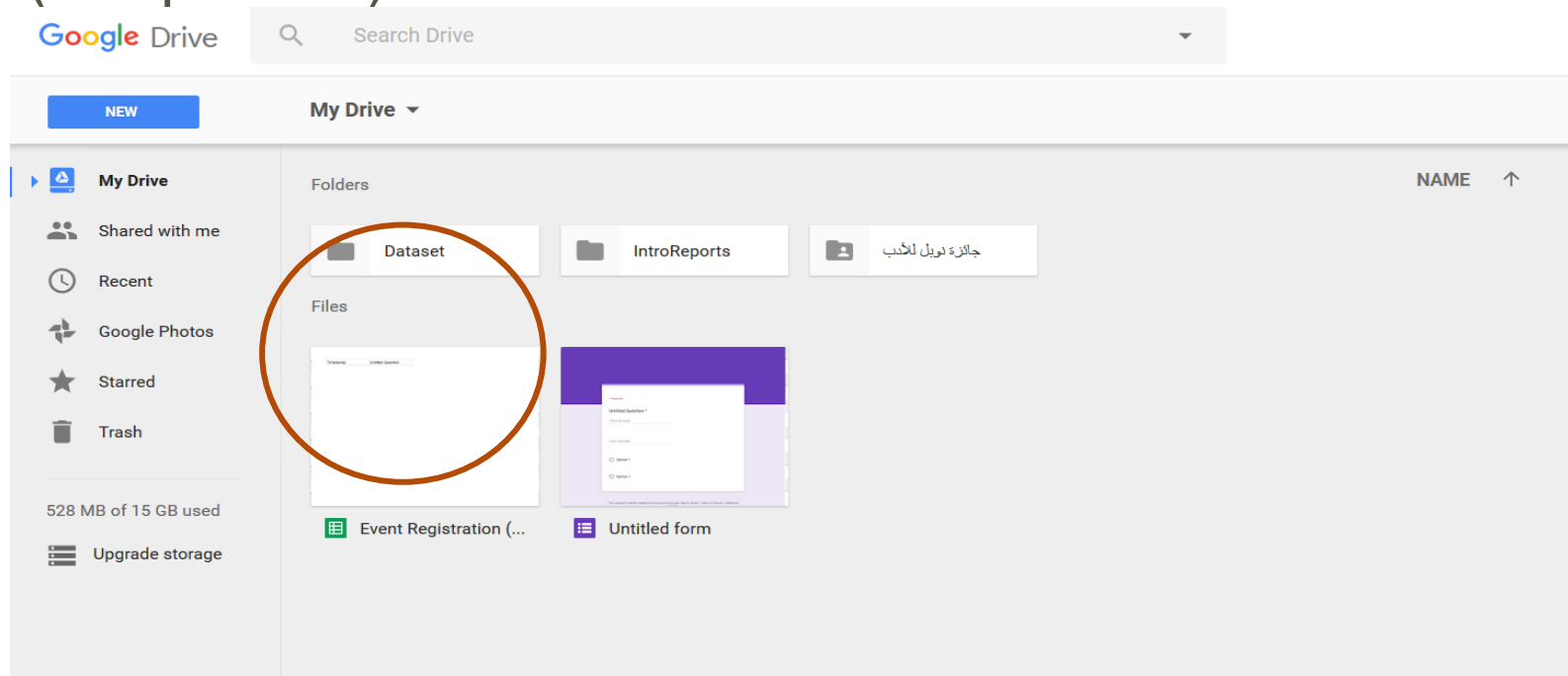
TA

Company (1 response)

Create Spreadsheet for the forms responses

# Collect Forms Responses(cont.)

- ✎ The created spread sheet will automatically added to the creator drive.
- ✎ The generated sheet will be named “form name (Responses)”.



**Next Lab is Quiz!!**



# Thank You