Introduction to Computers Lab
First Year (2017 – 2018)

ꕥ ꕥ

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
  - **$1024 = 1*10^3 + 0*10^2 + 2*10^1 + 4*10^0 = 1000 + 20 + 4$**

4^{th}	3^{rd}	2^{nd}	1^{st}	POSITION
$10^3 = 1000$	$10^2 = 100$	$10^1 = 10$	$10^0 = 1$	WEIGHT

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^{th}	3^{rd}	2^{nd}	1^{st}	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**.**
  - $\mathbf{7D1_{16} = 7*16^2 + 13*16^1 + 1*16^0 = 1792 + 208 + 1 = 2001_{10}}$
- An hex number can easily be converted to binary by replacing each Hex digit with the corresponding group of 4 binary digits.

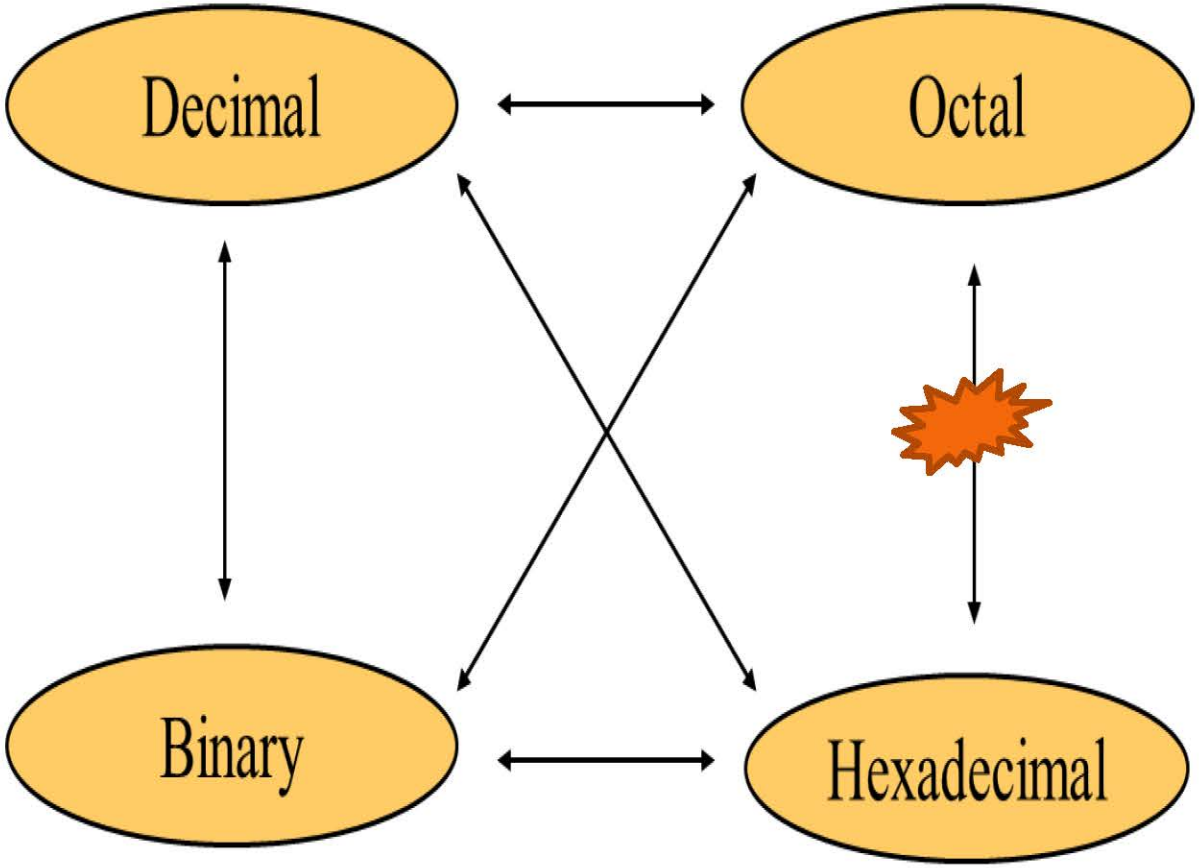
4^{th}	3^{rd}	2^{nd}	1^{st}	POSITION
$16^3 = 4096$	$16^2 = 256$	$16^1 = 16$	$16^0 = 1$	WEIGHT

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**.**
  - $\mathbf{7512_8 = 7*8^3 + 5*8^2 + 1*8^1 + 2*8^0 = 3914_{10}}$
- An octal number can easily be converted to binary by replacing each octal digit with the corresponding group of 3 binary digits.

4^{th}	3^{rd}	2^{nd}	1^{st}	POSITION
$8^3 = 512$	$8^2 = 64$	$8^1 = 8$	$8^0 = 1$	WEIGHT

Convert a number from any base to another



Decimal System

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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

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

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)
- $13_{10} = (..)_2$
- 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 x 2 = 0.750 integer 0 **MSB**
0.750 x 2 = 1.500 integer 1
0.500 x 2 = 1.000 integer 1 **LSB**

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

So $37.375_{10}=100101.011_2$

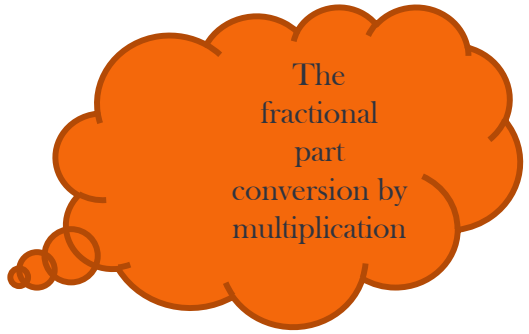
2-Convert from Decimal (cont.)

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 $23.68_{10} = 27.534_8$



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 → C **MSB**
    - 0.48 *16 =7.68 (0.68) and integer is 7 → 7
    - 0.68*16=10.88 (0.88) and integer is 10 → 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

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1-Convert to Binary System

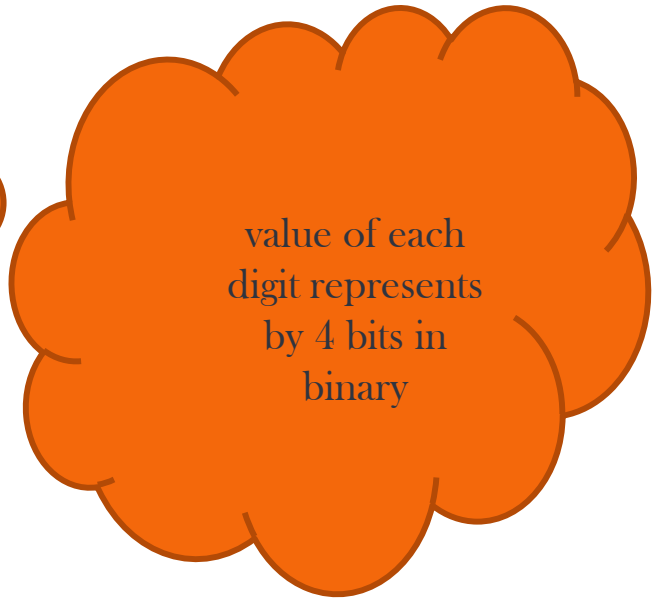
A. Convert From Hexadecimal to binary System:

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

$9F2.5_{16}$ = 9 F 2 5

= 1001 1111 0010 0101

= 100111110010.0101_2



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

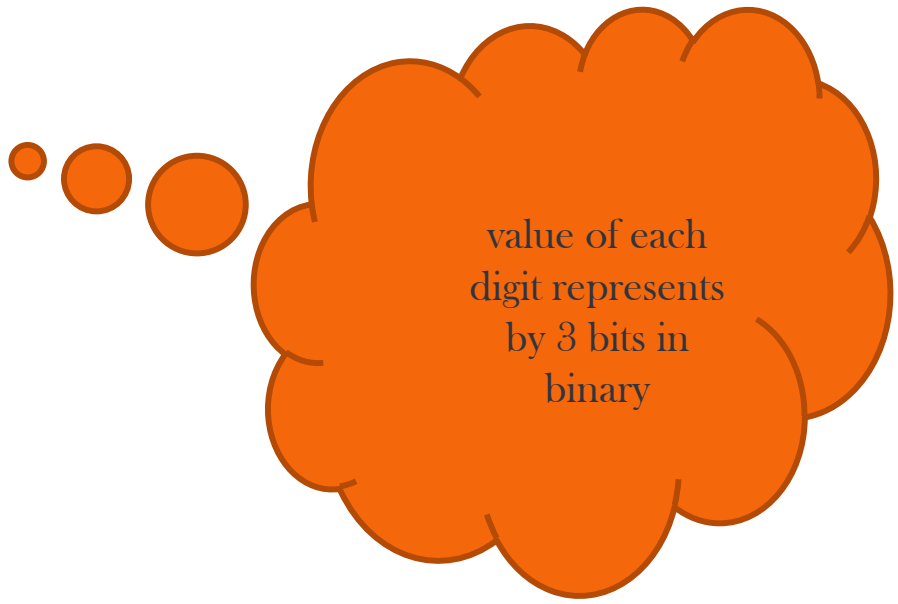
1-Convert to Binary System(cont.)

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

$$72.5_8 = \underset{\downarrow}{7}\quad\underset{\downarrow}{2}\quad\underset{\downarrow}{5}$$
$$= 111\quad 010\quad 101$$
$$= 111010.101_2$$

Excersices:

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



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:

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

$1\,1\,1\,0\,1\,0\,0\,1\,1\,0\,.\,0\,1\,1_2 = 0\,0\,1\,1\;\;1\,0\,1\,0\;\;0\,1\,1\,0\;\;.\;\;0\,1\,1\,0$

$3 \quad A \quad 6 \quad . \quad 6$

$= 3A6.6_{16}$

Excersices :

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

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:

$$1\,1\,0\,0\,1\,0\,0\,1\,0\,0\,.\,0\,0\,1_2 = \underbrace{0\,0\,1}_{1}\ \underbrace{1\,0\,0}_{4}\ \underbrace{1\,0\,0}_{4}\ \underbrace{1\,0\,0}_{4}\ .\ \underbrace{0\,0\,1}_{1}$$

$$= 1444.1_8$$

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

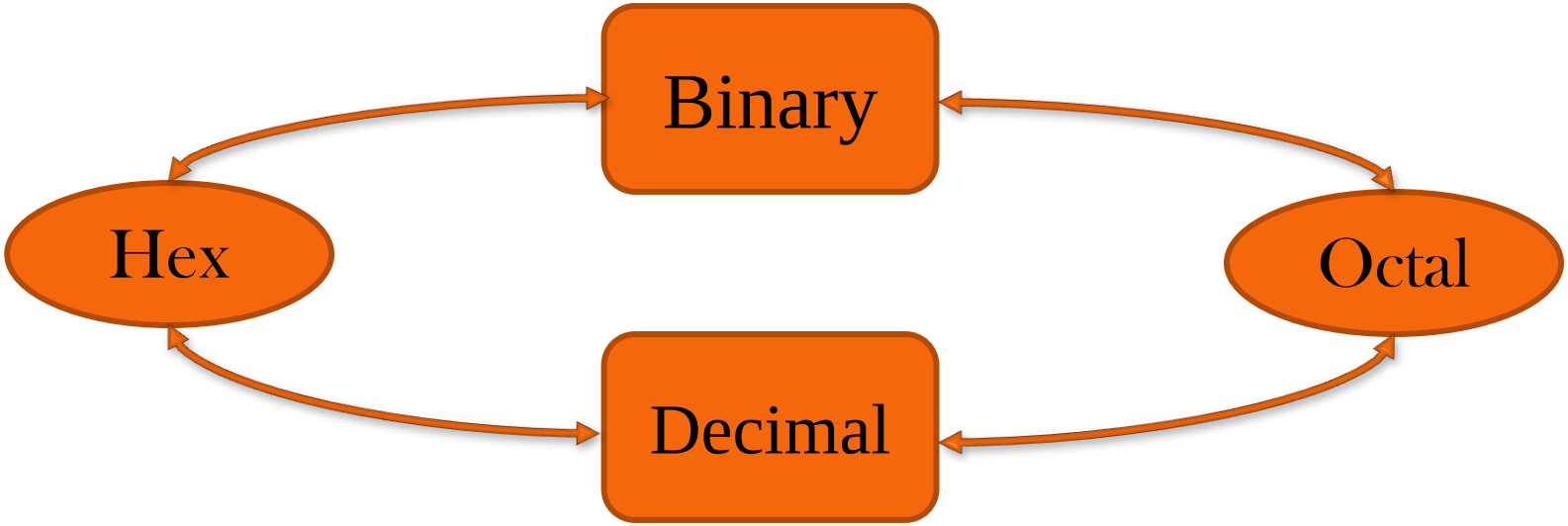
Find:

1. $1101.1001_2 = ???$

2. $110101.101_2 = ???$

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 remainder 1

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

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

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

So $A1_{16} = 241_8$

- Using binary

$A1_{16} = 1010\ 0001_2$

Octal to hex Conversion

- Example: $71_8 = (\ldots)_{16}$
- Solution:
- Using decimal

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

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

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

  $3_{10} / 16 = 0$ 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 represented in n digits

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

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

- When
  - n = 5
  - n = 10

- **How many digits needed to represented 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

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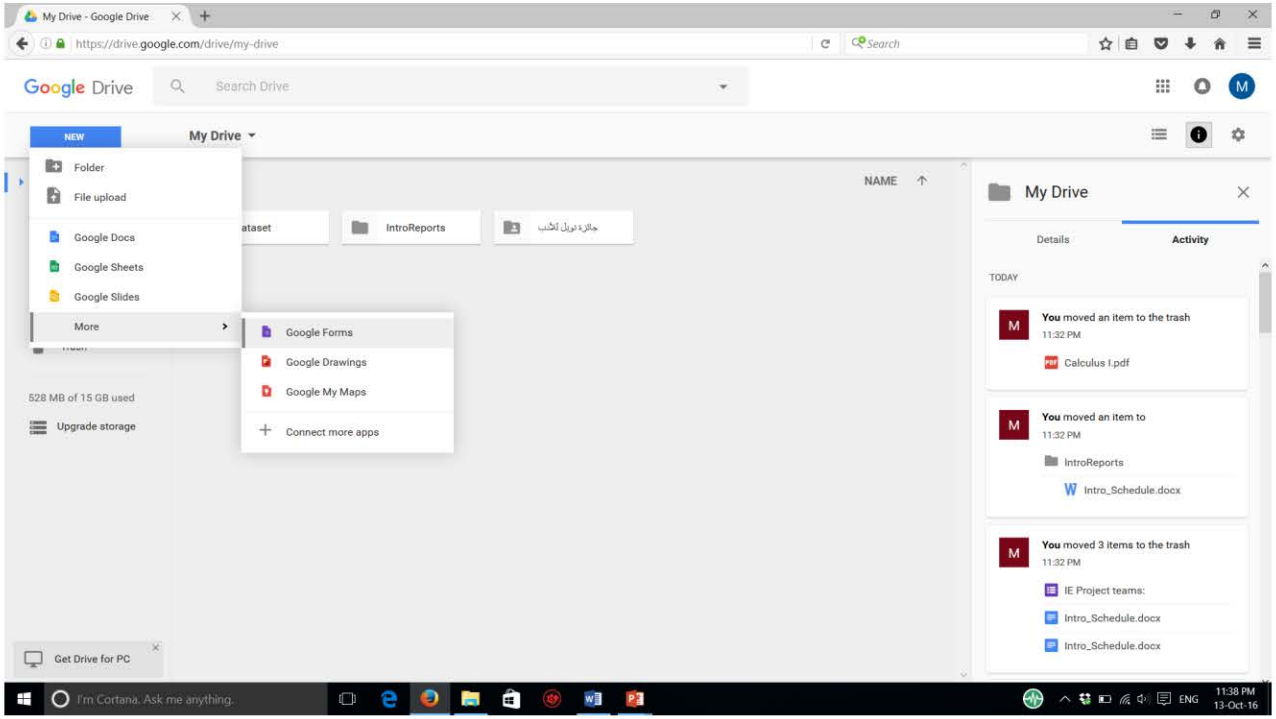
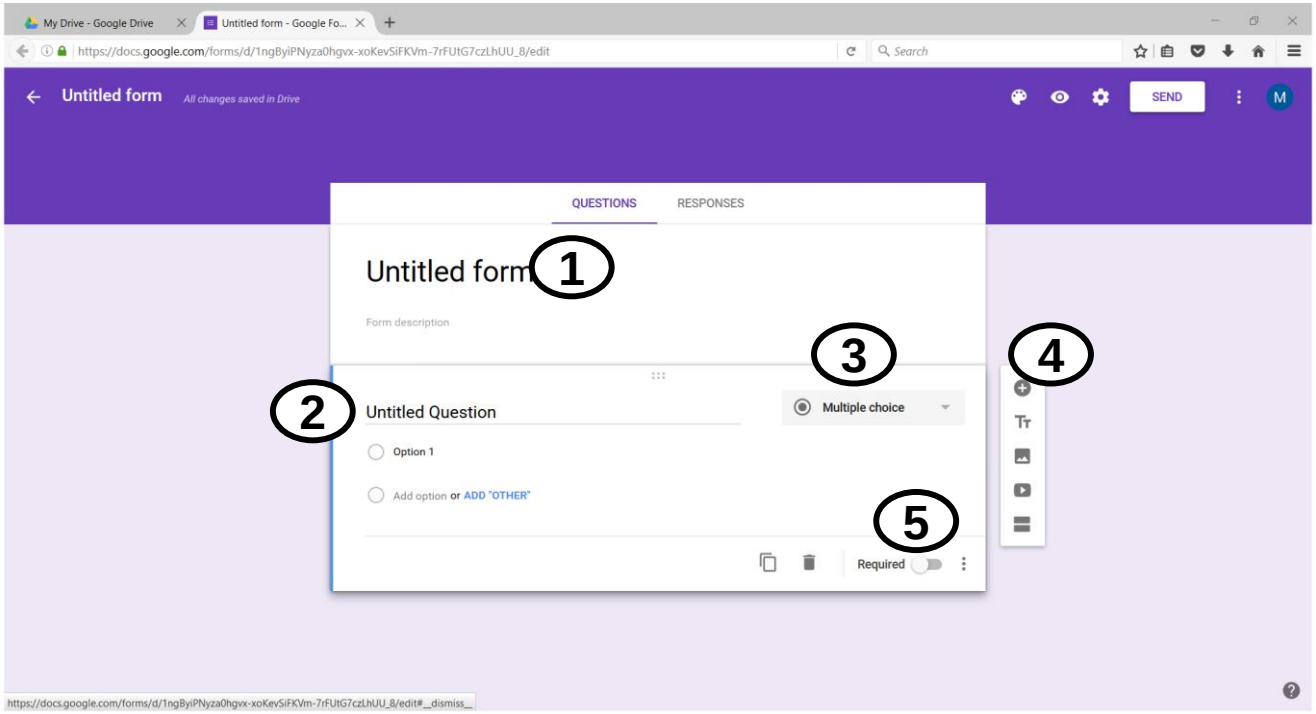
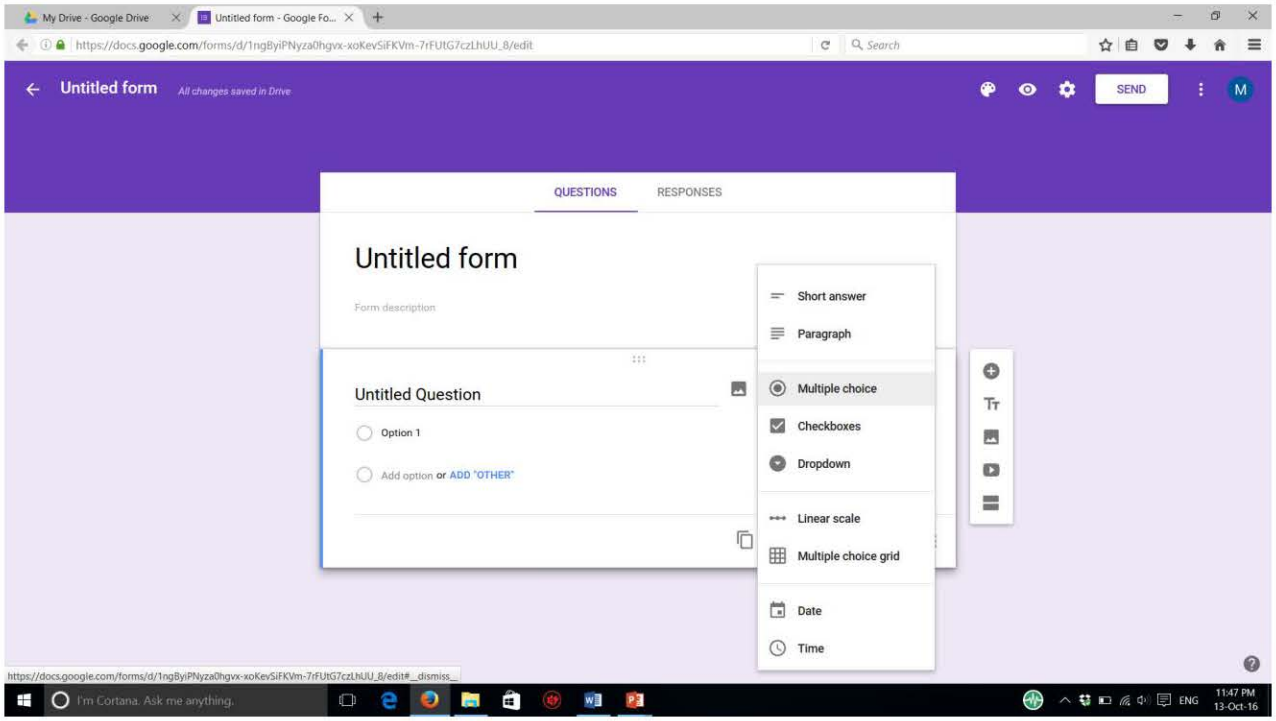
Creating Forms



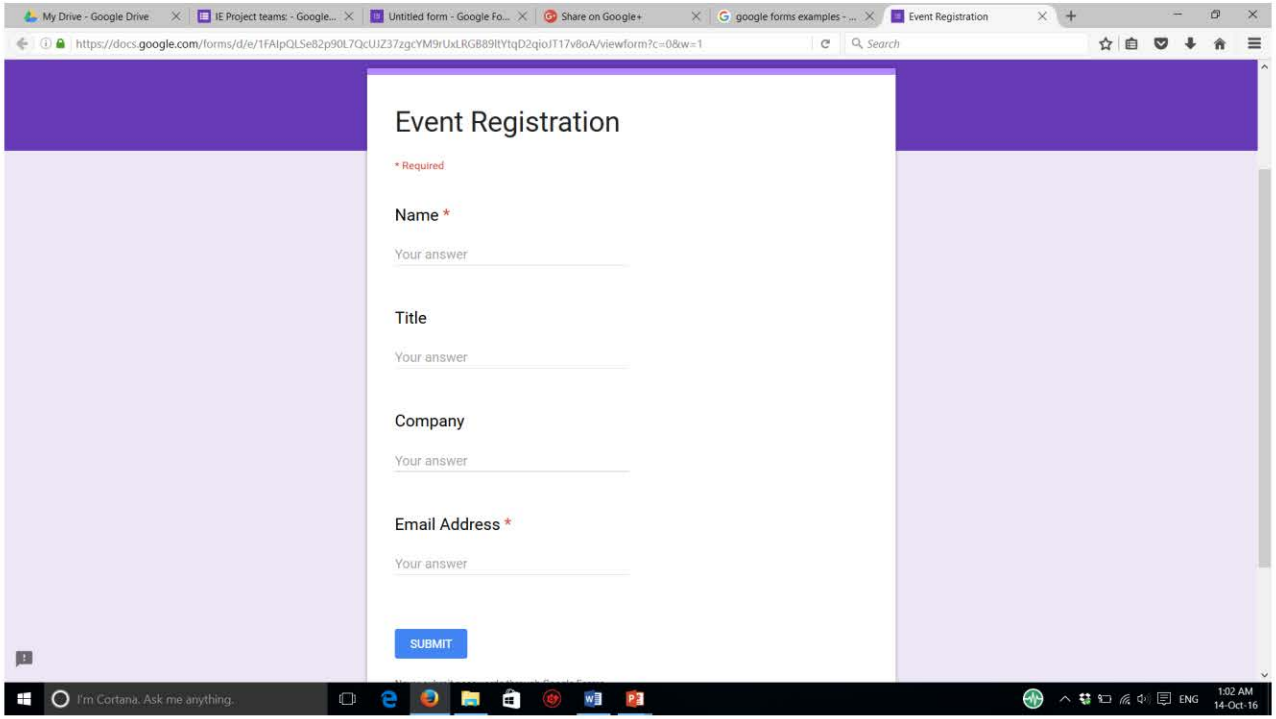
Add and Edit Questions



Questions types

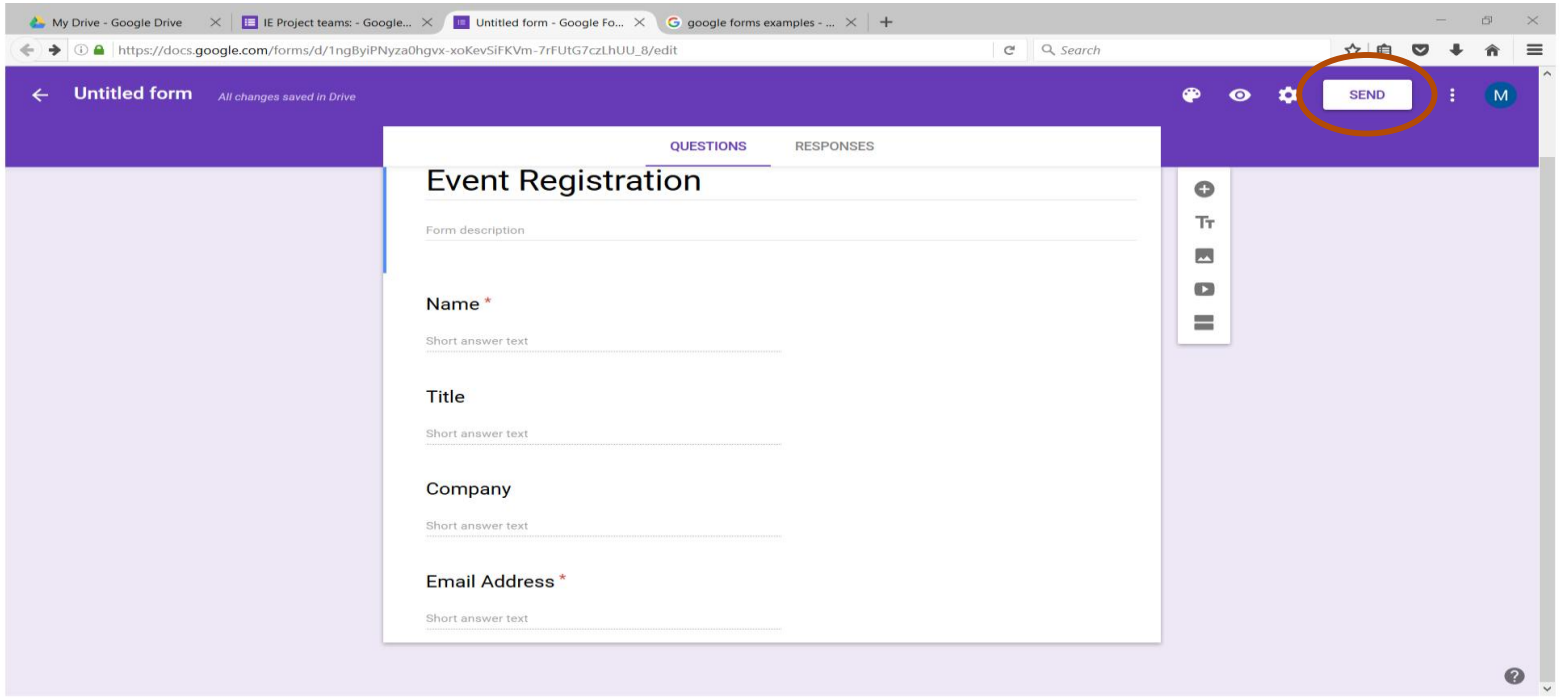


Exercise

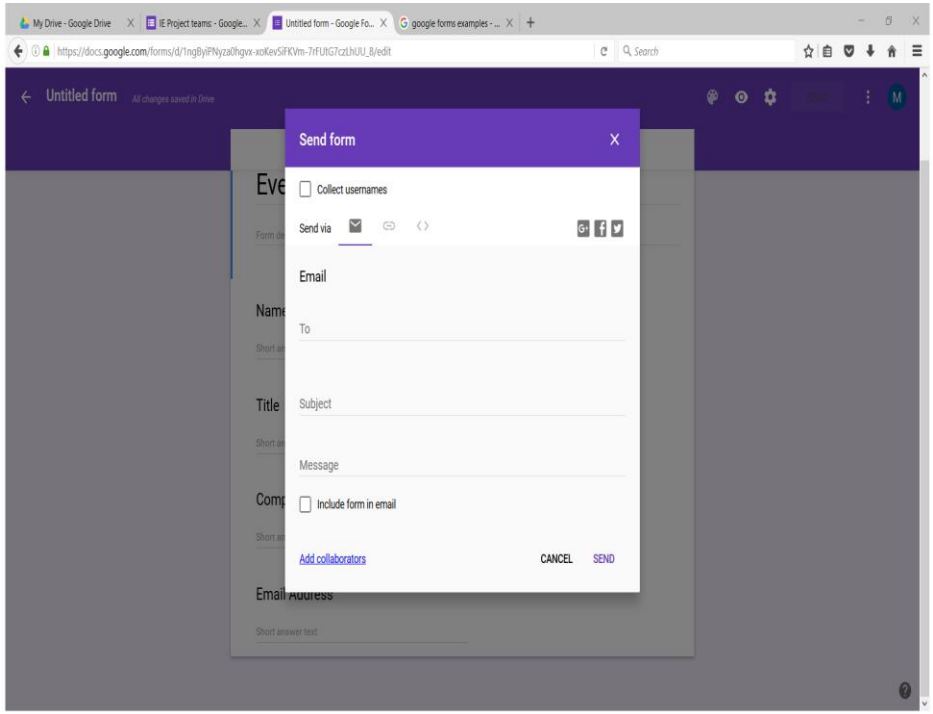

My Drive - Google Drive
IE Project teams: - Google...
Untitled form - Google Fo...
Share on Google+
google forms examples - ...
Event Registration
https://docs.google.com/forms/d/e/1FAIpQLSe82p90L7QcUJZ37zgcYM9rUxLRGB89ltYtqD2qioJT17v8oA/viewform?c=0&w=1
Search
Event Registration
* Required
Name *
Your answer
Title
Your answer
Company
Your answer
Email Address *
Your answer
SUBMIT
I'm Cortana. Ask me anything.
ENG
1:02 AM
14-Oct-16

Sharing Forms

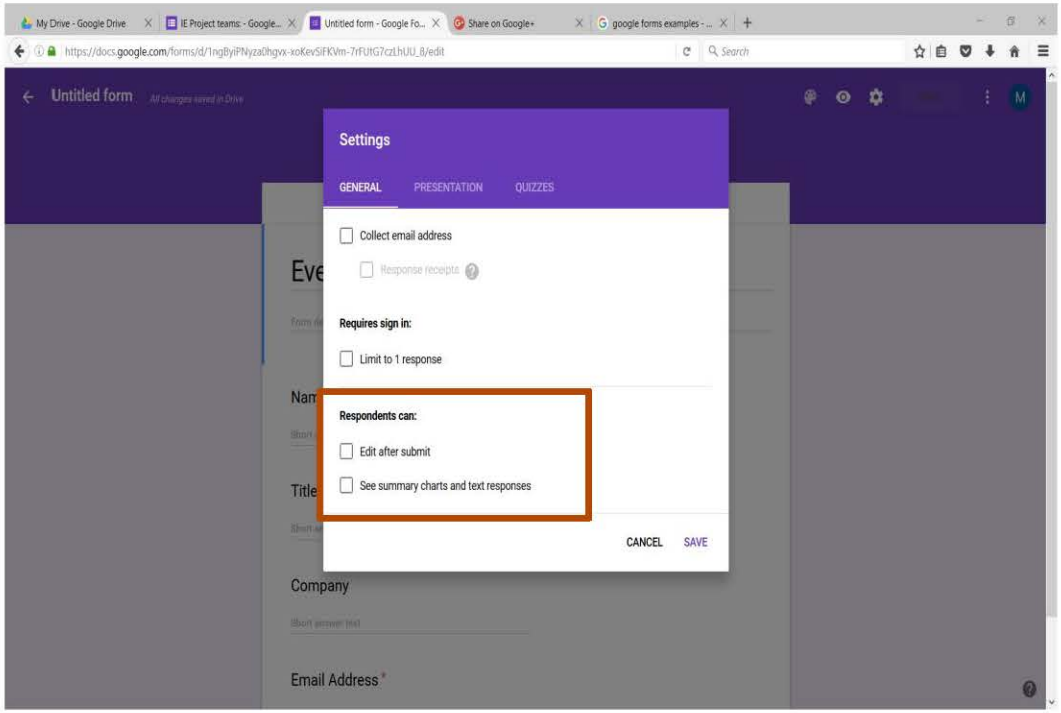
- In order to share the created form with others use **Send** button.



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

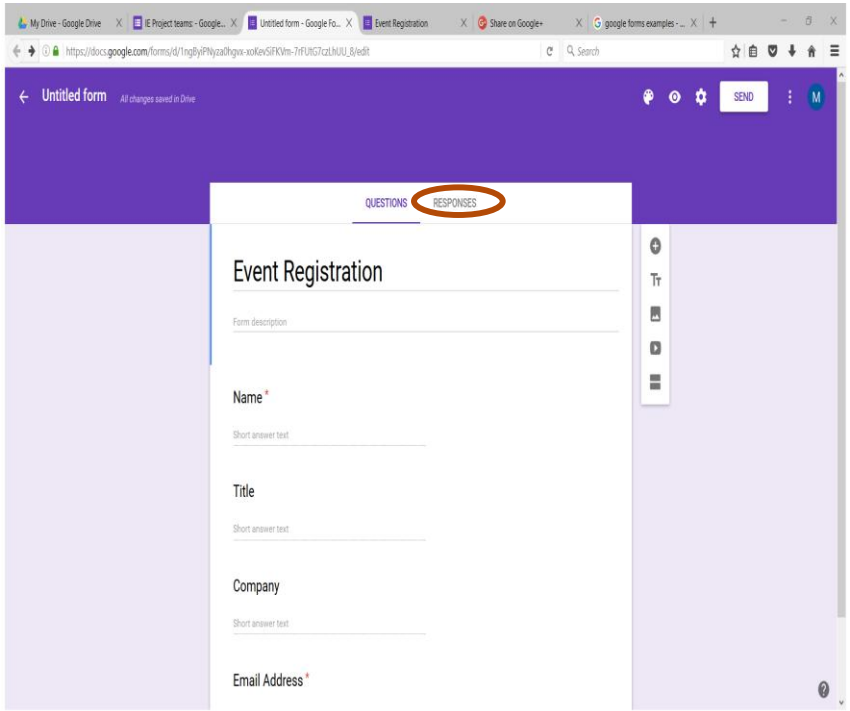


Form Settings

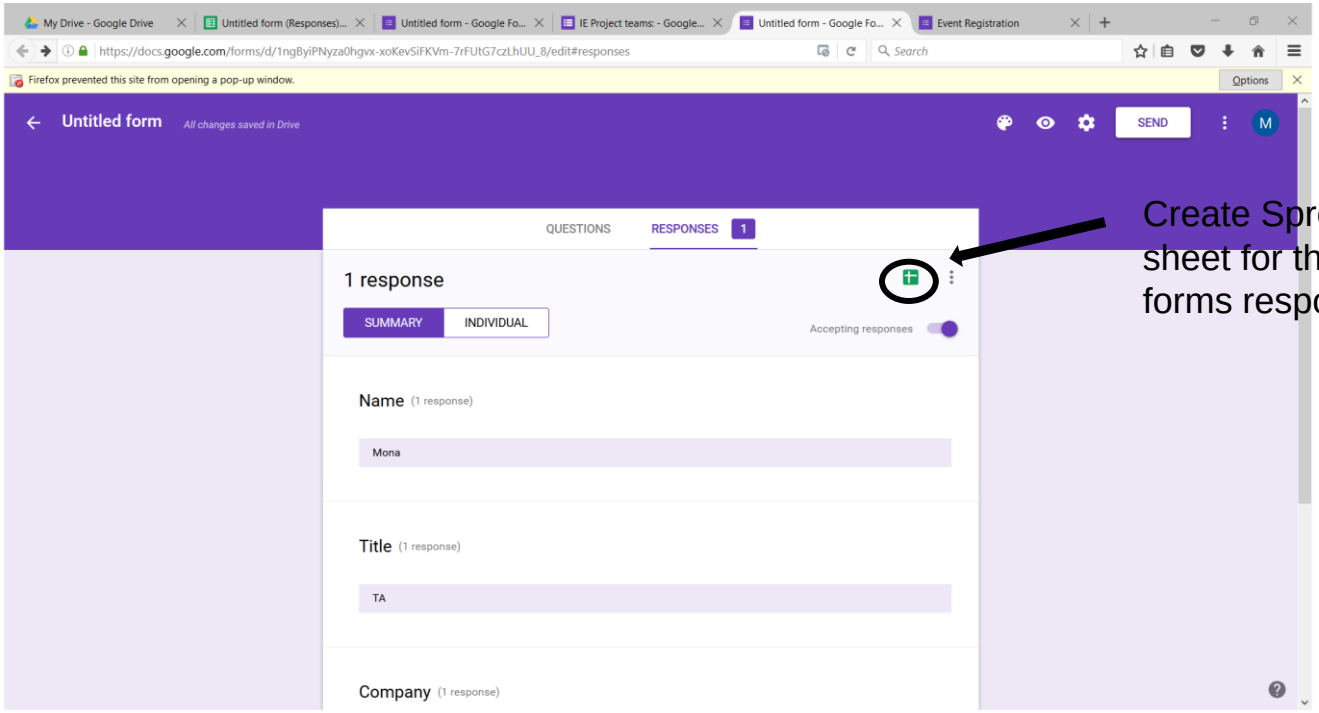


Collect Forms Responses

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



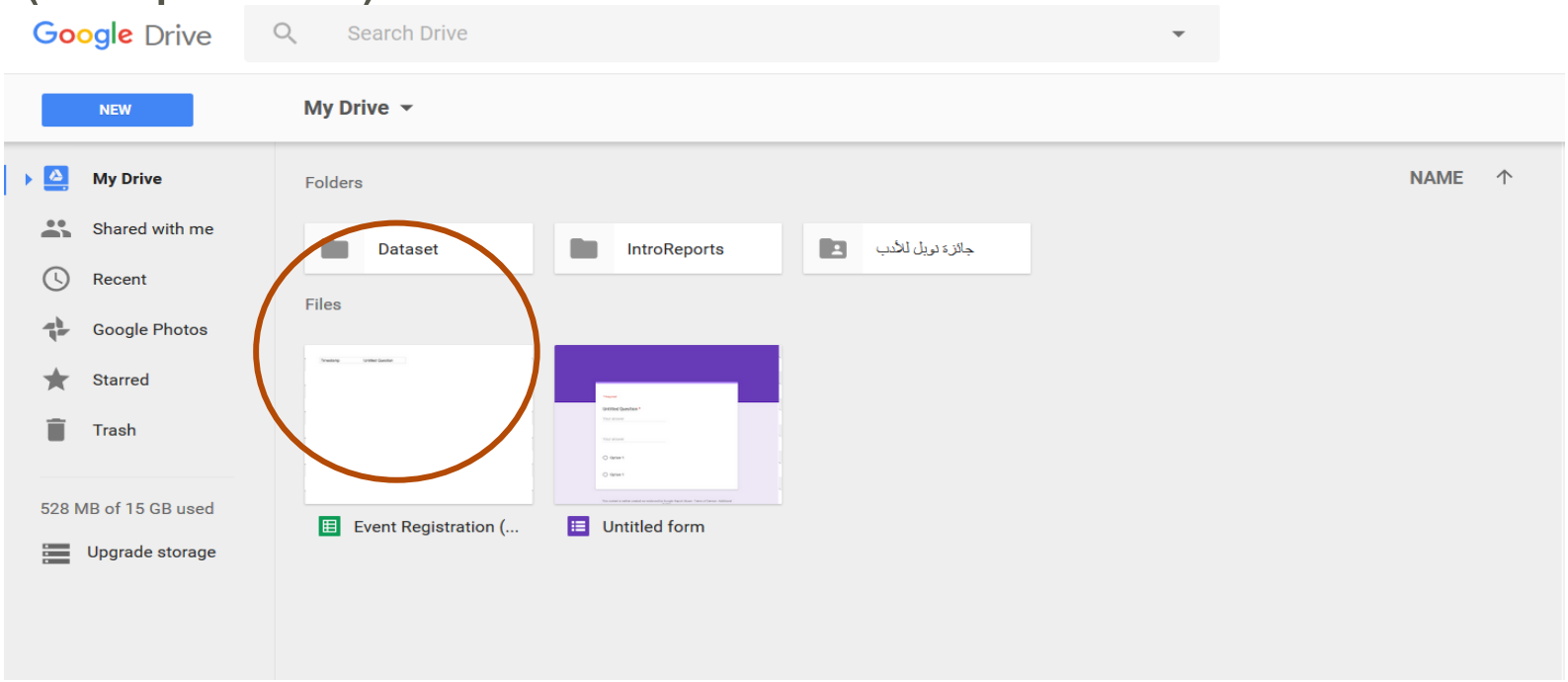
Collect Forms Responses(cont.)



Create Spread sheet 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