Part01

Q1. What is the difference between int.Parse and Convert.ToInt32 when handling null inputs?

Int.Parse(null) = throws ArgumentNullException

Convert.ToInt32(null) = 0

Q2. Why is TryParse recommended over Parse in user-facing applications?

TryParse is handling bad arguments by returning 0 then complete the remaining program unlike the Parse which in this case throw an exception and the program will be crashed

Q3. Explain the real purpose of the GetHashCode() method.

It's a number to check if two objects points on the same reference or not (in case of referenced types)

If valued types it returns a value that represents its hash code in the stack

Q4. What is the significance of reference equality in .NET?

When we put obj1 = obj2 that means the references of them will equal to other not only their values

Q5. Why string is immutable in C#?

It's the most efficient in case reading, no much modifications.

No a lot of modifications = No a lot of unreached objects

Q6. How does StringBuilder address the inefficiencies of string concatenation?

String builder uses linked list (dynamic) so each char points to the other. This allows us to insert/remove into a specific position or appending with less space complexity. In addition to being mutable so editing any SB this means we will edit the same object and won't create a new obj

Unlike strings that are static (arrays of chars) then any operation will force us to create a new modified object (or destroy the old one then create a new one [GC do this after the memory has been filled])

Q7. Why is StringBuilder faster for large-scale string modifications?

Because of using linked lists in SB not just static arrays. This ease modifications to prevent memory wasting.

Q8. Which string formatting method is most used and why?

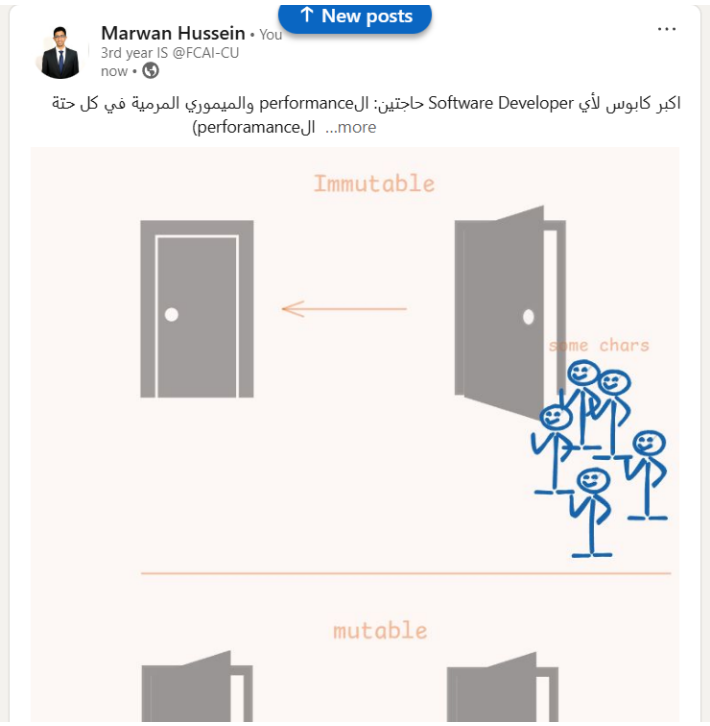
String Interpolation (using $) -> it's more readable and using less memory and we can use math and logic in it.

Q9. Explain how StringBuilder is designed to handle frequent modifications compared to strings.

	SB	String
type	Dynamic	Static
immutable	false	true
initially uses	Linked list	Arrays
best for	a lot of modification	read only data
shortcomings	high complexity (compared with strings)	memory wasting if we used it in a lot of modifications

Part02

1- LinkedIn article about string immutability (https://www.linkedin.com/posts/marwan-hussein-568373314_dotnet-softwareengineering-performance-activity-7422776756459368448-nSuZ?utm_source=share&utm_medium=member_desktop&rcm=ACoAAE_JsmABvTFVwhoN_Ti9LOJQCQO2JKvt0pM)



2- What's Enum data type, when is it used? And name three common built_in enums used frequently?

Enum = Enumeration: distinct value type -> allows us to create a set of named constants

When it used:

* using some magic keywords (instead of numbers) based on numbers like Red Black Tree (Enum elements are Red =0, Black=1)

* to make the code readable

Examples:

* ConsoleColor: to change text or background of the terminal like values (Red, Green, Blue,..)

* HttpStatusCode: (OK = 200, NotFound = 404, InternalServerError = 500)

* DayOfWeek (Sunday = 0, Monday = 1, ..etc)

3- what are scenarios to use string Vs StringBuilder?

String: static strings, using threads in a system

SB: a lot of modification in some string

Part03 (Bonus)

4- self-study report

1. Composite formatting
   Takes a list of objects (string + format items). The arguments are indexed from 0 to n-1 {n: #of format items}
   How works: parsing the string for curly brackets {}, then placeholder the suitable item in the suitable index

   If the passed obj is a valueType then we Box it to be as referenced type (.toString()) that moves the obj from the stack to the heap

2. Interpolation formatting
   Syntactic sugar, when compiling, the compiler transforms an interpolated string into string.Format call anyway

3. .rdata section
   Read-only data section
   In general, the compile sort the daya into different buckets based on how these data will be used. The rdata section is the bucket fror strings that need to be seen by the program but shouldn't be changed while the program is running
   e.g. constants, strings, import info

4. How the jump happens in switch
   Using jump table:
   Cases in the switch stored in rdata section
   So if the value not in the range (min, max) -> goto the default scope

   If cases are close to each other (like 1,2,3,4) then preform the case's index in the rdata
   Else if they are far like (1,100,1e6): perform them as BST (binary search tree) or hash table to treat with string cases. This make us to avoid wasted memory

5. Evolution of if/switches in C# versions
   C#7:

```
switch (Shape){
     Case Circle c:
          Block of code
}
```

   This allows you to check the type of the key and assign it to an obj c

   C#8:

```
string msg = status switch{
     0 => "inactive"
     1 => "Active"
     _ => "Unknown"
}
```

   This allows you to return a data type (string for ex) from the switch based in the key (status in our ex)

5- what meant by user defined constructor and its role in initialization

The role of initialization to initialize objects with a specific algorithm (may take parameters or something)

6- compare between Array and Linked List

	Array	**Linked List**
memory allocation	Contagious cells	not must to be contiguous

type	static	dynamic
random access	yea	no
accessing speed	fast [O(1)]	slow [O(n)]
memory waste	can be if the array almost empty	minimal waste