Developer Support Engineer Interview test

1. Please solve the following problems. You can use the Unity Documentation, Scripting Reference, Stack Overflow, Google, etc:

1.1. Extend the following vertex and fragment shader to use Light Probe illumination from the scene, affecting the object being rendered.

Shader "MyShader/Diffuse With LightProbes" {

Properties { [NoScaleOffset] \_MainTex ("Texture", 2D) = "white" {} }

SubShader {

Pass {

Tags {

"LightMode"="ForwardBase"

} CGPROGRAM

#pragma vertex v

#pragma fragment f

#include "UnityCG.cginc"

sampler2D \_MainTex;

struct v2f {

float2 uv : TEXCOORD0;

float4 vertex : SV\_POSITION;

};

v2f v (appdata\_base vertex\_data) {

v2f o;

o.vertex = UnityObjectToClipPos(vertex\_data.vertex);

o.uv = vertex\_data.texcoord;

return o;

}

fixed4 f (v2f input\_fragment) : SV\_Target {

}

} ENDCG

} }

fixed4 col = tex2D(\_MainTex, input\_fragment.uv);

return col;

Find the answers in my Git under Unity files/Unity entrance test or you can install 1.1question.unitypackage

The shader is located in Assets/Materials/1.1. I made 2 versions: one with shadows and one more simple with only Light Probes affecting the color. I wasn’t sure if the question implies shadow management or not.

1.2. Create a native plugin with a function written in C/C++, which is called from Unity in a C# script and receives the following struct from C#:

struct TwoStrings {

string string1;

string string2;

string concatenated;

}

After calling the native function from C#, passing as argument an object of type TwoStrings, the variable “concatenated” of the object will store the two strings in

“string1” and “string2” concatenated.

1.3.  Create a Unity project using Unity’s C# Job System to calculate the sum of the R channel, for each texture element of a texture. To do this, split the texture into four regions of equal size, the operation should be processed by jobs **running in parallel**.

1.4.  Use VFX Graph to create a particle system that moves along a Bezier curve.

This question had to be made in their own Unity project (Unity files/Question 1.4) Because VFX Graph uses HDRP and URP so it will interfere with the question 1.1

1.5.  Create two prefabs using cubes with a shared material, packing each prefab into a separate asset bundle. Use a script to load the prefabs and instantiate them in the scene. Do not use Addressables.

Find the answers in my Git under Unity files/Unity entrance test or you can install 1.5question.unitypackage

2. Please, try to answer the following questions in your own words:

2.1.  Describe what each of these technologies are and what they can be used for:

2.1.1.  Scriptable Build Pipeline

The Scriptable Build Pipeline lets you program and customize the way the project is compiled/built with your own C# code or with pre-made code that comes with Unity. The SBP is generally used to improve build time or have more control over the general building flow.

Can be used for: Improving building time

2.1.2.  Scriptable Render Pipeline

Similar to SBP, SRP is an API that allow us to programmatically control certain default processes that Unity usually handles automatically. In contrast to SBP, SRP is focused on how graphic rendering is computed; it let us control and schedule the rendering commands with C#.

Since the High Definition and Universal Render Pipelines are built over SRP you can customize them as well, optimizing your rendering process to be able to include more polygons and particles on screen, include higher detailed materials and light effects with the same processing power

Can be used for: Optimize rendering processes, therefore, include better graphics

2.1.3.  Addressables

Addressables is an asset management system that allows the programmer to reference an asset and its dependencies from anywhere with any dependencies asynchronically using its address. It is generally used with Asset Bundles to include (download) some content from an online server, lighting the app/game’s initial weight and allowing developers to modify or include assets without having to re-build the project and publishing it all over again.

Can be used for: Deliver on-line assets or modify files more dynamically since you only to have modify the addressabled asset instead of the whole project.

2.1.4.  IL2CPP

IL2CPP stands for Intermediate Language to C++, that means, it converts C# code to C++. Then, the converted C++ is used to create a native compilation for a specified platform.

If it is true that IL2CPP builds slower than Mono, the built product may run faster since it is compiled in native, so no translation is needed at runtime.

Another main feature is that IL2CPP enables 64 bits builds on Android and iOS, a now obligatory requirement for publishing apps on the Appstore and Google Play.

Can be used for: Create 64-bits apps/games, compile on native and allow Unity to include more devices on their cross-platform rooster.

2.1.5.  Nested Prefabs

Nested Prefabs are simply Prefabs inside another Prefab. Nested prefabs instances reference their own prefab asset while, at the same time, are part of one or more parent prefabs. One useful implementation of nested prefabs is for standardizing interfaces and have more control over their changes (see example bellow)

As you can see here, (1) We can have a Canvas prefab with a header prefab nested.

(2) If we edit the children header prefab asset and insatiate it multiple times inside the parent prefab, I will maintain the properties of the children prefab asset.

(3) It doesn’t matter if both parent and children are under the control of two separated developing teams. Any change made either on the parent core, as well as the children will be reflected on the final prefab with the nested one.

Can be used for: If there is a big asset with many pieces that may change over the developing course, the use of nested prefabs can facilitate all the workflow by allowing different teams work on individual parts simultaneously.

2.2.  Mention at least two problems of Unity’s non-incremental Garbage Collector.

One problem is that NIGC uses BDW garbage collector which is a stop-the-world process and, since it happens automatically it may run at unexpected times, stopping the game/app at unpredicted moments until the GC finishes its process. On quick reaction games this may become a critical issue, mainly because on first person shooters, a small halt of processes might result in a difference between kill o being killed.

Another problem is that a NIGC run its process all at once so usually you see spikes in the Profiler CPU’s. On games, that might interrupt a constant or smooth 60 fps rendering.

Unity now offers incremental GC that it seems to cope with those problems on most cases. (It also presents some drawbacks on specific cases such as when the IGC enters in a long inventory loop because many assets are changing constantly so it has to run again)

2.3.  Explain which of these is better and why? Unity LTS, TECH release, Beta or Alpha?

It depends: If you are building software that needs to be stable, include support and may be updated in the future but without using new technologies, then Unity Long Term Support is the best pick, because this version is released after various rounds of debugging making it generally, the most stable version. Besides, Unity has a commitment of giving support to LTS for 2 years with patches and minor updates.

On the other hand, if you are preparing yourself for what is in the near future of Unity, you are in an R&D team whose scope is to find new tools rather than actually developing a production game/video/app and don’t really care about support. Then, beta or alpha releases might be your fit.

2.4.  What is your preferred version control system and why do you prefer it over others?

Honestly, if I’m working with a team, the Collab system from Unity is my default choice. Simply because is a well simplified VC. And, if you are working with a multidisciplinary team, that is something that really matters. Some artist, 3D designers, Illustrators and UX/UI designers have never used a VC and trying to introduce Git to them, may become a nightmare, even if the git is connected to a visual desktop client.

With Collab, you simply push a button to commit and push, you can back to a certain point without leaving the unity editor and that’s it! Simple yet effective when working with a non-programmer team.

Plus, if its well configured, you can make a cloud compilation from the pushed version saving you a lot of time.

2.5.  What is your favorite IDE and why?

It highly depends on the language I’m programing. There is not a perfect-fit-for-all IDE really.

Here is my favorite list:

* For web-dev on Python, Java, JS, Php, etc., I prefer using any of the specialized Jet Brains IDEs because in most cases, they include an incorporated terminal, automatic git tracking, they are good at text competitions, offers on-the-run error tracking, effective hotkeys + shortcuts and the core compiler is simply efficient. The only drawback is that if you want to include all the features to your IDE install, you will have to pay extra.
* For Native Android, of course Android Studio. Simply because it’s a Google IDE for a Google framework. They offer excellent documentation, and you are always up to date since it’s all built inhouse. The same applies for X-Code an iOS.
* For “multi-coding”, I really like brackets. It’s open source, it has a dropdown inline editor that helps a lot when working with complex CSS and HTMLs and their plugin system is fantastic for adding new functionalities even for not supported languages.
* Finally for Unity, I must admit that I never liked Visual Studio, and when Unity dropped support for MonoDevelop I was disappointed. But I retract myself when I really started using Visual Studio Community and years later, VS Code.

But, back to my first statement… Jet Brains just knows what a developer wants: Rider for Unity is lightweight as VS Code, but robust as VS Community; it has a built in Unity Editor controller for running and stopping the Editor within Rider, includes Shader support, has a test environment and debugger that seems made by Unity itself, it has project usage finder, the text competition works better than VS and even have optimization recommendations. I recently discovered that by pressing Ctrl+Shif+F1, you can go straight to Unity’s documentation! I sincerely wouldn’t ask for more from an IDE made for Unity.

2.6.  What issues or limitations have you recently experienced using Unity?

I have a few, hope you don’t hate me for what I’m about to say…

One of the main limitations I have experienced is the non-effective way to manage UI for mobile. When working from native, there are already made templates and interfaces. You just input a line of code and the compiler renders a basic UI layout. With Unity you must do that by hand. I know that Unity is not specialized on making App platforms, but God only knows how many times my apps have not been accepted by Apple for not using their “apple interface layout”. At least a Prefab with standardized canvas for iOS and Android would be really nice.

And talking about Apps development, it would be really nice to include an automatic “view history” so when an user presses the back key on android it displays a certain previous view. I know that it is something complicated to know what comes first and after in an event-oriented game, but I have seen many creative ways the community handles this solution. An official integration would be terrific.

Another limitation I have experienced on Unity WebGL builds are the non-existent virtual keyboard support for mobile. I know that WebGL is not officially supported on mobile by Unity, but since it’s a web product, many users will try to open the product on mobile. I’m just crossing my fingers that project Tiny will include virtual keyboard support on their golden release.

2.7.  What strategies or best practices can be used to optimize the CPU and GPU usage in an application made with Unity?

1. Constantly check the profiler, any recurse hungry process always is shown in the profiler.
2. Use LODs
3. Implement an effective occlusion culling parameters to hide whatever is not shown
4. Use the proper compression for audio depending on their use.
5. Use the simplest collider shape whenever is possible
6. Limit yourself to include the less quantity of code inside the Update function
7. Prevent using of rigid bodies as much as possible
8. Bake lighting and use reflection probes.
9. Use efficient shaders and particles
10. Batch GO
11. Reuse components as much as possible.
12. Maintain your textures and sprites as a power 2 value (512,256,128,…) and create atlas whenever possible.
13. Disable the “Raycast Target:” bool on any UI object that does not interact with anything.
14. Be sure to erase or deactivate any unused code.
15. Be efficient on the type of data collection you use (arrays, lists, dictionaries) taking into account each pros and cons every collection has when adding, deleting, searching and sorting

2.8.  How do you catch and investigate crashes happening in a released game?

I have different strategies depending on the platform I am working with. In general I like to use Cloud Diagnostics from Unity’s Sevices. This service is very useful because users can even report an issue with the User Reporting (Although you have to download an SDK and install it correctly).

Besides that, on high end games I also use Firebase Crashlytics because some errors that Firebase catches, are not reported by Unity’s Cloud Diagnostics and vice versa.

Google has a now robust crashes and ANR reporting embedded inside the Google Play Console. Apple, on the other hand has tools inside X-Code that lets you test and see crashes while running your device connected to the computer. Their crashes report from ~~itunesconnect~~ Appstore connect is really usefull but it requires to build with Symbol Information.

2.9.  Compare the following function and macro definitions. In what cases will they produce different results and/or side effects?

**int square(int val) { return val\*val; }**

**#define square(val) (val\*val)**

There are two cases where the macro definition will throw a different result:

1. In case ‘val’ is not a number, the function will throw an error while executing it. Macros do not have type checking nor compilation error checking so is possible any artifact may occur.
2. In case the ‘val’ value is a composed operand for example val= 1+2 the function will return 9 which is correct, but the macro definition will respond with a 5 because the definition will treat the calculation as 1+2\*1+2. To fix this, I would declare the macro definition as follows:

**#define square(val) ((val)\*(val))**

* 1. What is the package manager in Unity and what is the alternative way of adding a package than via the package manager UI?

The package manager is a centralized package viewer, that let us see all the installed packages, as well as all available packages for installation. Here you can also update, remove, and download all your packages for any project and keep track of all your packages in a compact and organized way.

For adding a package outside the package manager UI, you can go to:

**Assets>Import Package>Custom Package…**

Another alternative is by dragging the package from your file explorer, into the Unity Editor; or simply, double clicking on the .unitypackage file to open and import it inside the last opened Unity project.

2.11.  Examine the following function. What does it accomplish?

int someFunction(int i) {

int n = 0;

while (i) {  
i &= i-1;

n++; }

return n; }

It counts and returns how many bits (1) are in a specific integer.

How does it work:

Let’s choose int i=7 for this example:

* The while loop won’t stop until i=0; any other value will be considered as true. n will only count how many loops the function has gone through.
* The ‘&=’ operand can be translated to i = i & i-1;
* The & (instead of the && logical operand) is used for bit comparison, therefore i=7 will be treated as i=111 which is their binary equivalent. Each bit is compared with their pair in the exact same index.
* Therefore, the loop will go like this:

|  |  |  |
| --- | --- | --- |
| 1st run | 111 &110=110 | n=1i=110 |
| 2nd run | 110 &101=100 | n=2i=100 |
| 3rd run | 100 &011=000 | n=3i=000 |

The 4th run never happens since i==0 and 0 is read as false in the while loop.