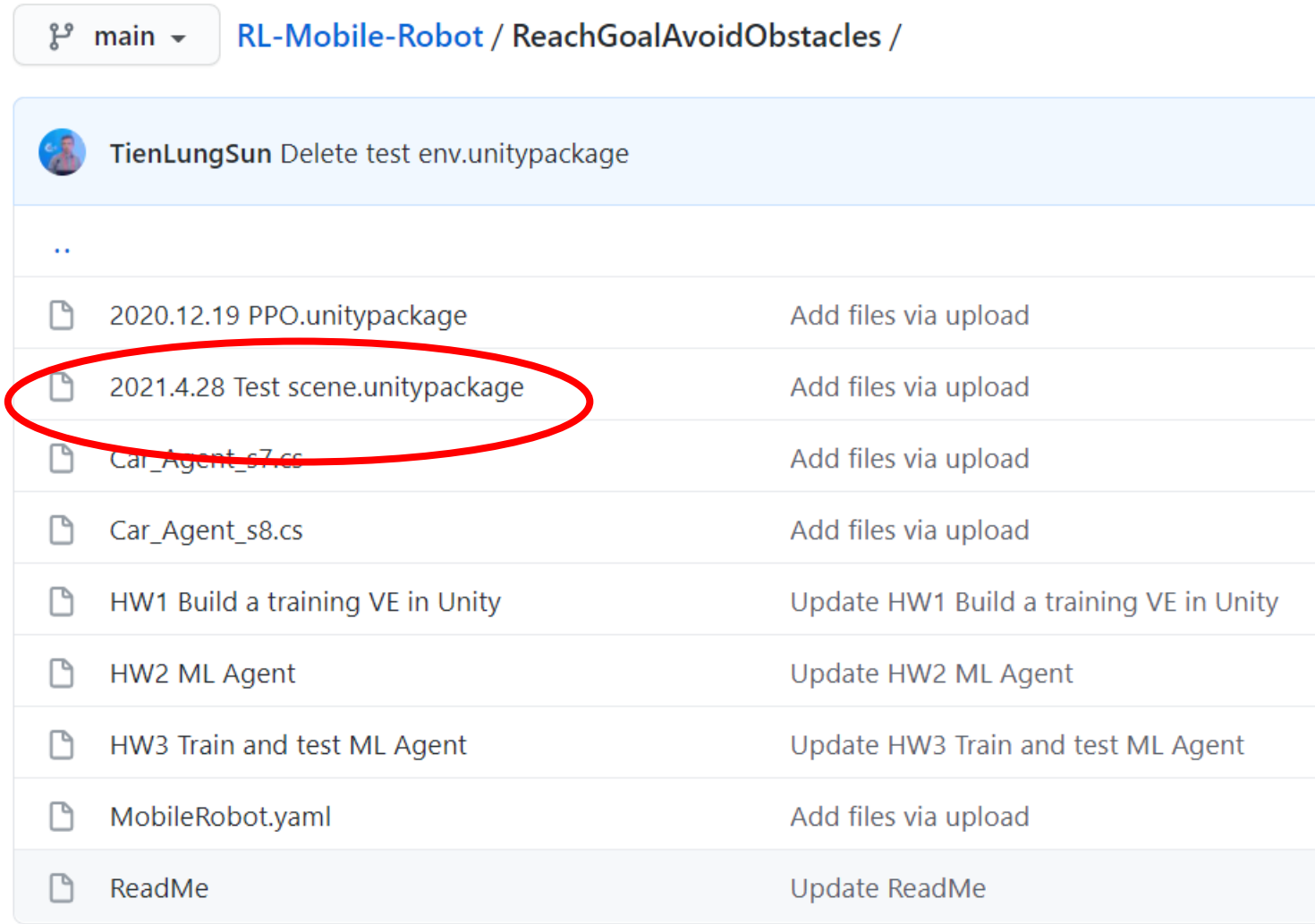
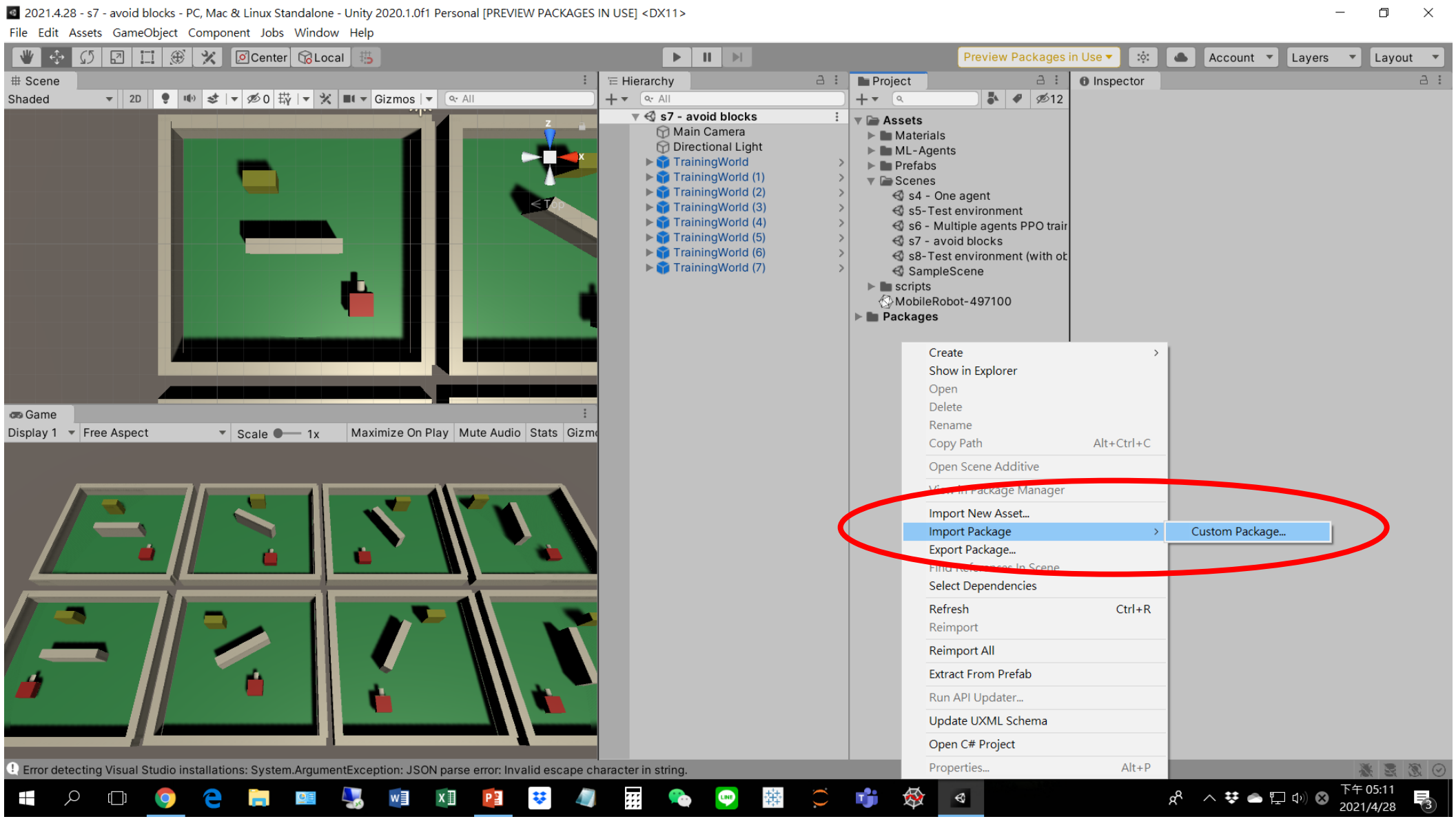
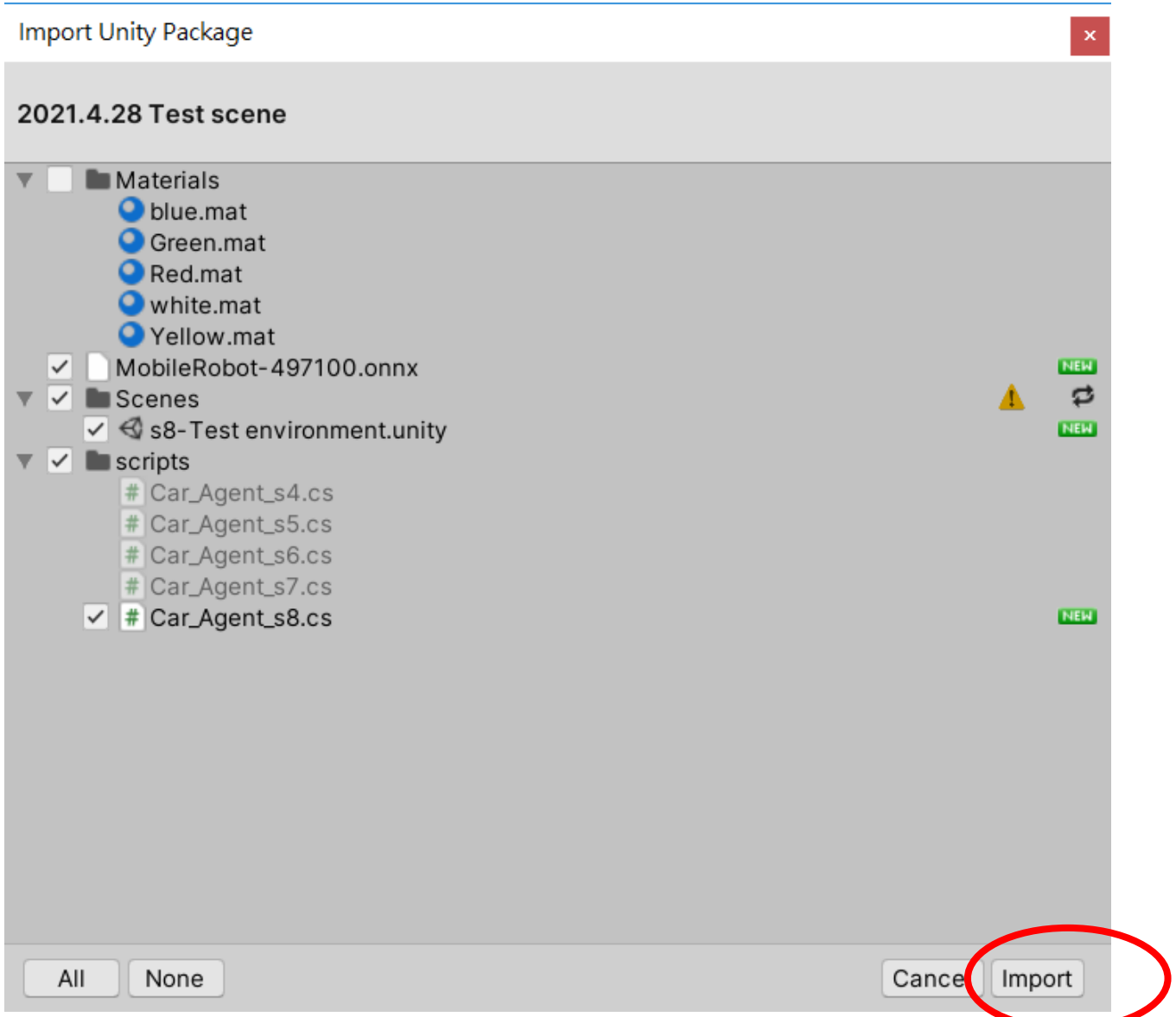
1. Download Unity package from my GitHub



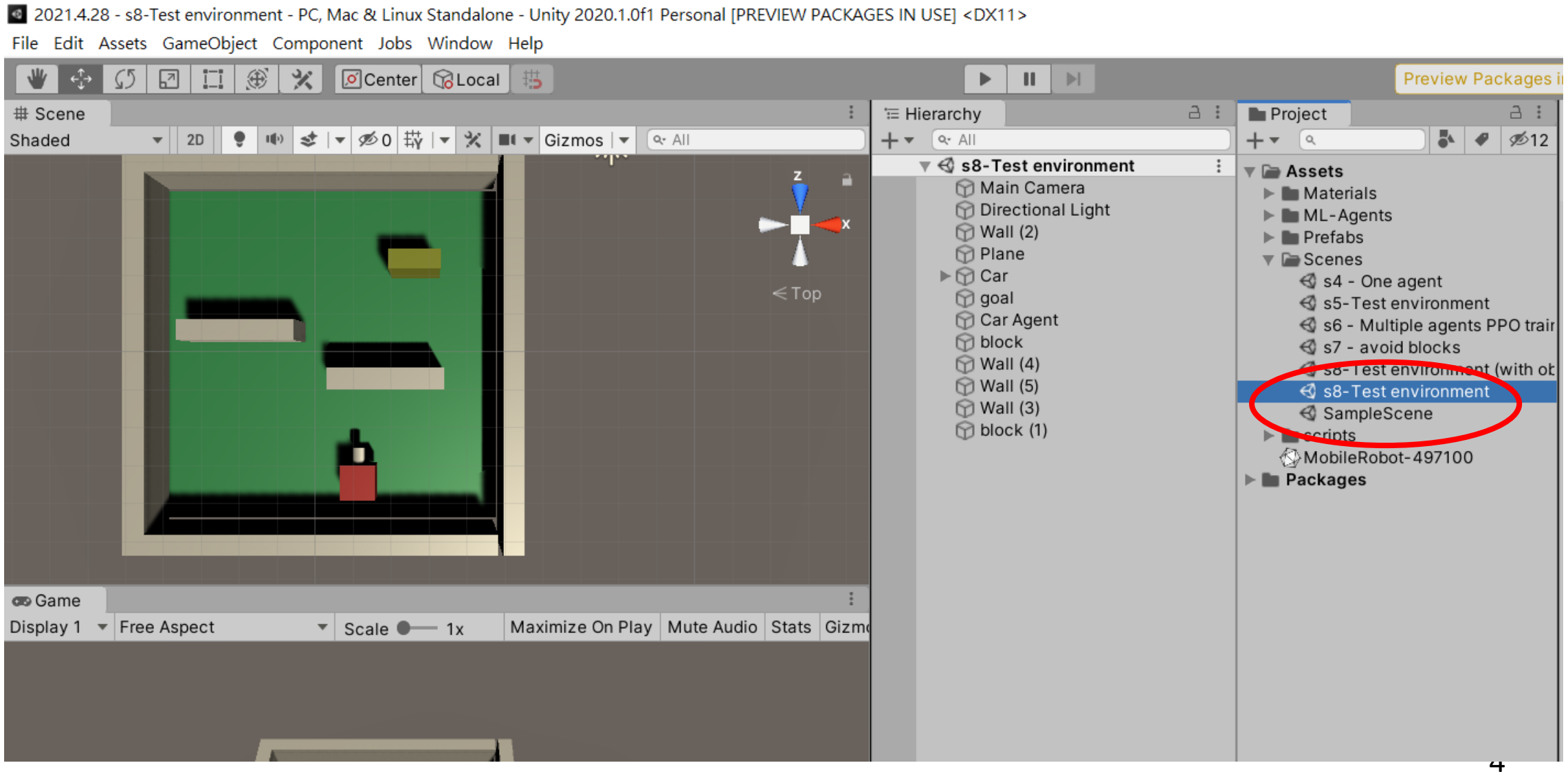
2. Import Unity package



2. Import Unity package

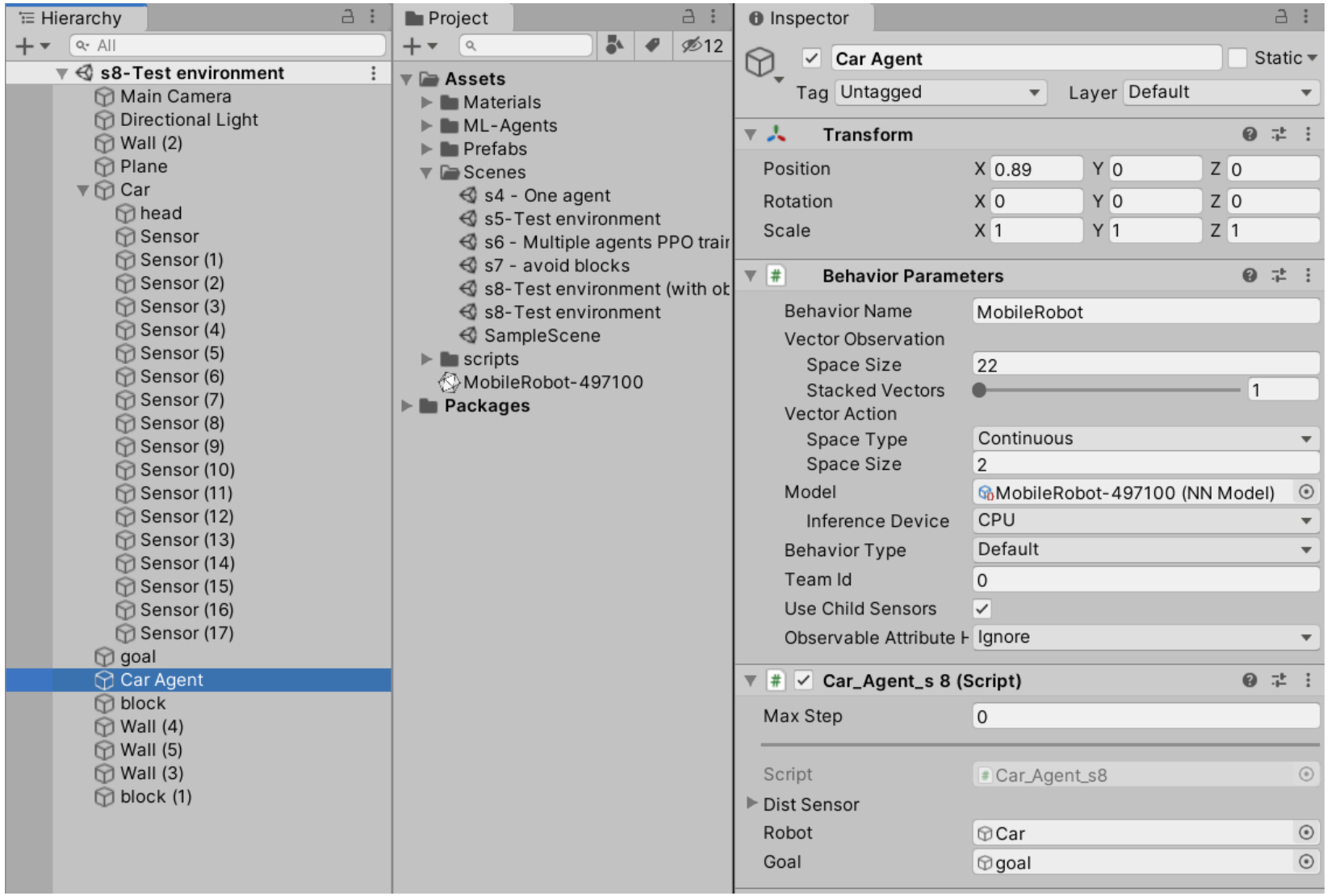


2. Import Unity package



Car Agent

In the test scene, the Decision Requester component is removed.



Car Agent script

Car_Agent_s8.cs | Car_Agent_s7.cs

Assembly-CSharp | Car_Agent_s8

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using Unity.MLAgents;
using Unity.MLAgents.Sensors;
using System.IO;
using System;

public class Car_Agent_s8 : Agent
{
    public Transform[] distSensor = new Transform[18];
    RaycastHit hit;
    public GameObject robot, goal;
    float rayLength = 4.0f;
    Vector3 CarOriginalPos;
    int TotalTests, NoTest;
    string filePath;
    StreamWriter writer;

    void Start()...

    private void OnApplicationQuit()...
```

Using modules

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using Unity.MLAgents;
using Unity.MLAgents.Sensors;
using System.IO;
using System;
```

Class and variables

```
public class Car_Agent_s8 : Agent
{
    public Transform[] distSensor = new Transform[18];
    RaycastHit hit;
    public GameObject robot, goal;
    float rayLength = 4.0f;
    Vector3 CarOriginalPos;
    int TotalTests, NoTest;
    string filePath;
    StreamWriter writer;
```

Start

```
void Start()
{
    CarOriginalPos = robot.transform.position;
    TotalTests = 2; // test the NN model performance for N times
    NoTest = 1;
    string t = System.DateTime.Now.ToString();
    filePath = "trajectory.csv";
    writer = new StreamWriter(filePath);
    writer.WriteLine("time, x, y, reward");
}
```

On Application quit

```
private void OnApplicationQuit()
{
    writer.Close();
}
```

On Episode Begin

```
public override void OnEpisodeBegin()
{
    robot.transform.position = CarOriginalPos; //Back to original position
    robot.transform.rotation = Quaternion.Euler(new Vector3(0, 0, 0));
}
```

Reach goal or not?

```
Boolean ReachGoal()
{
    bool result=false;
    for (int i = 0; i < 18; i++)
    {
        if (Physics.Raycast(distSensor[i].position, distSensor[i].forward, out hit, rayLength))
        {
            if (hit.collider.tag == "goal" && ((i >= 0 && i <= 2) || (i >= 16 && i <= 17)) && hit.
                goal with front end
            {
                result = true;
            }
        }
    }
    return result;
}
```

Update

```
void Update()
{

    if (NoTest <= TotalTests)
    {
        if (ReachGoal() == false)
        {
            RequestDecision();
        }
        else //reach goal
        {
            string s = "Finish No " + NoTest.ToString();
            writer.WriteLine(s);
            NoTest = NoTest + 1;
            EndEpisode(); // Finish this test and start next test
        }
    }
    // else NoTest already larger than TotalTests, do nothing, wait
}
```

On Action Received

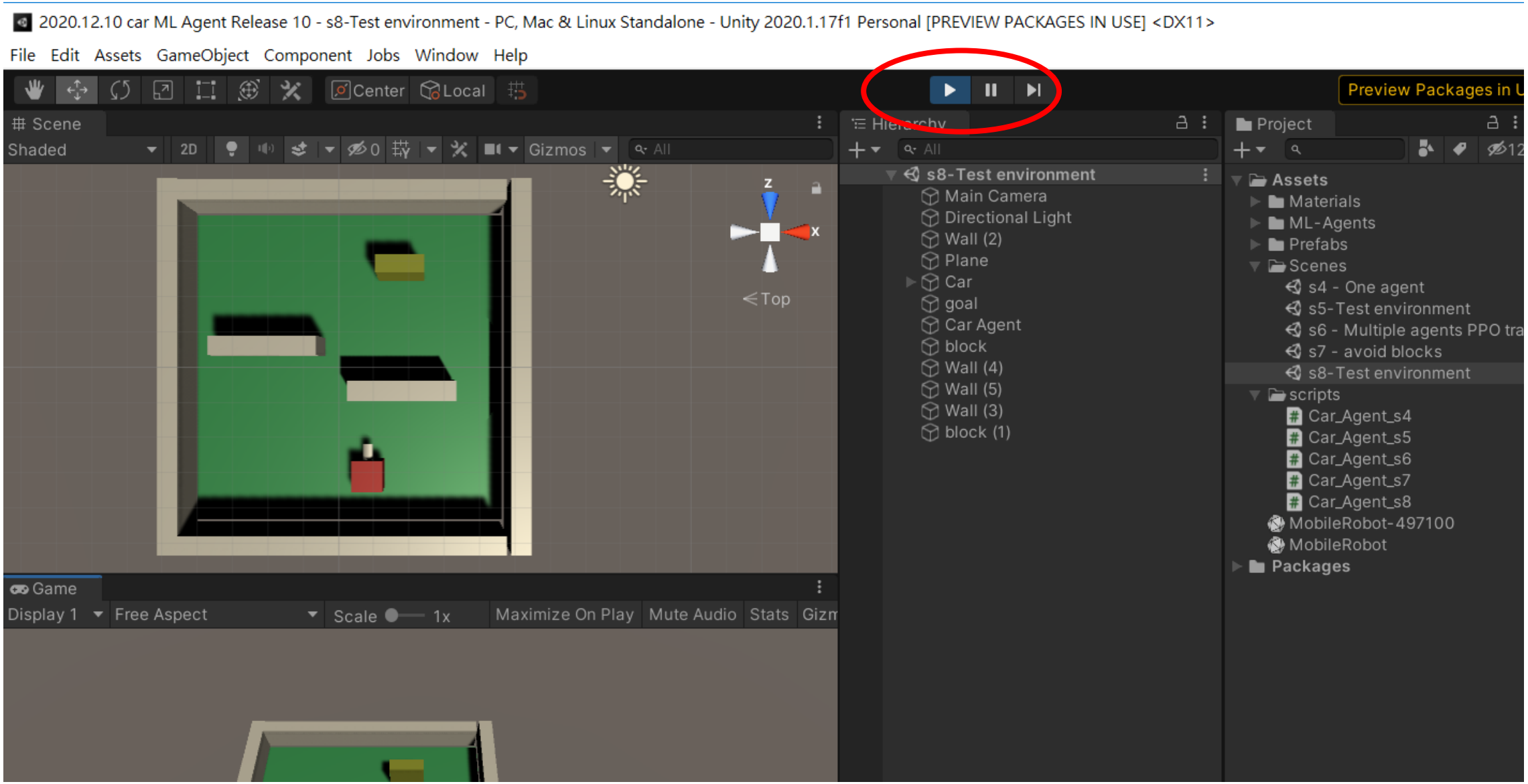
```
public override void OnActionReceived(float[] vectorAction)
{
    robot.transform.Translate(0, 0, vectorAction[0]*0.2f);
    robot.transform.Rotate(0, vectorAction[1]*10.0f, 0);

    //record time, (x, y) position and reward
    string t = System.DateTime.Now.ToLongTimeString();
    float x = robot.transform.position.x;
    float z = robot.transform.position.z;

    float reward = 0.0f;
    int newStage = DetermineStage();
    reward = reward- 0.005f * newStage; //punish more steps no. and steps
    for (int i = 0; i < 18; i++) //Part II: rewards based on distance sen
    {
        if (Physics.Raycast(distSensor[i].position, distSensor[i].forward
        {
            if (hit.collider.tag == "goal" && ((i >= 0 && i <= 2) || (i >
                goal with front end
            {

                reward = reward + 100;
            }
```

3. Play


2020.12.10 car ML Agent Release 10 - s8-Test environment - PC, Mac & Linux Standalone - Unity 2020.1.17f1 Personal [PREVIEW PACKAGES IN USE] <DX11>
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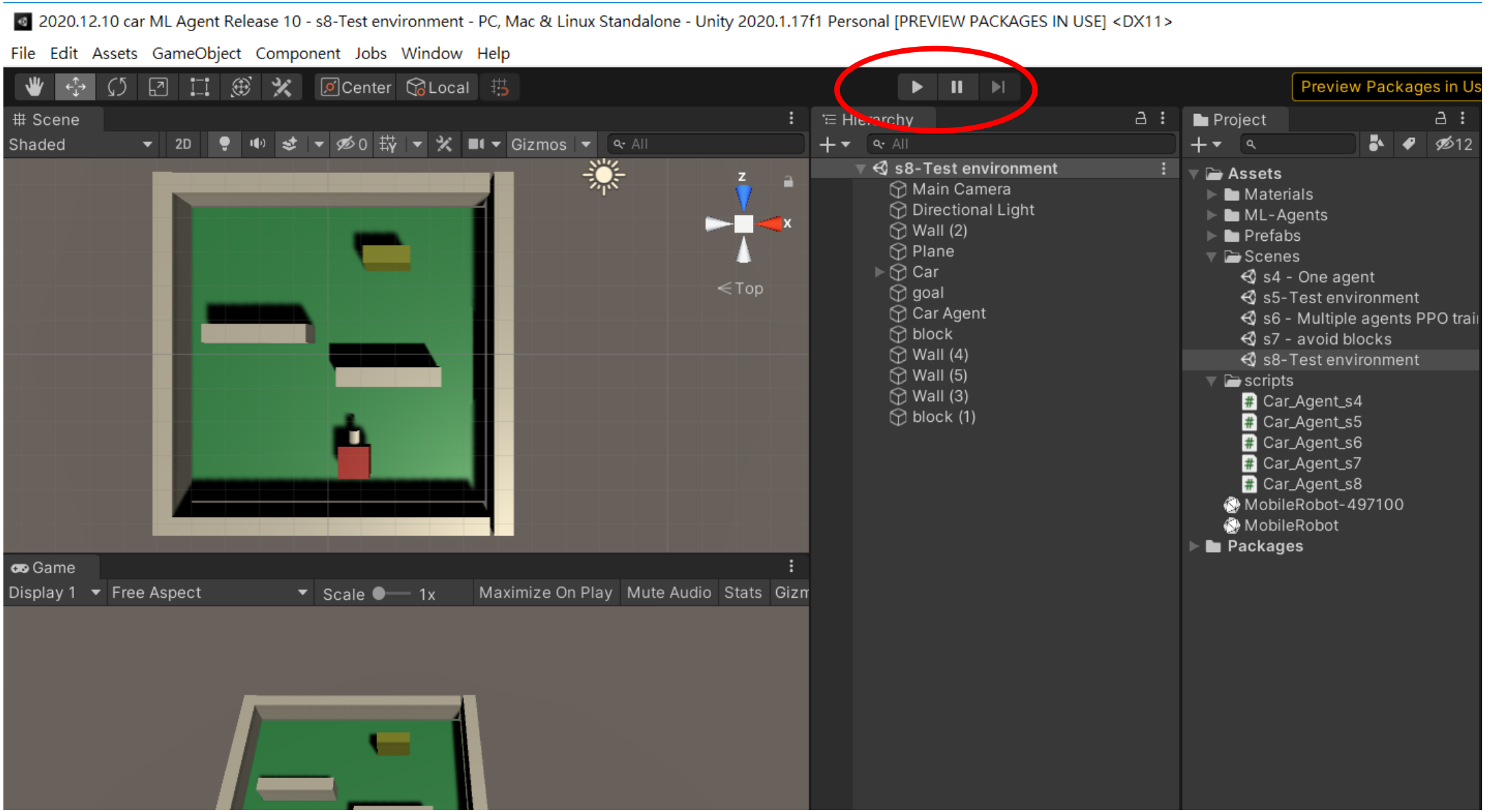
Scene
Shaded 2D Gizmos All
Top
Game
Display 1 Free Aspect Scale 1x Maximize On Play Mute Audio Stats
Hierarchy
All
s8-Test environment
Main Camera
Directional Light
Wall (2)
Plane
Car
goal
Car Agent
block
Wall (4)
Wall (5)
Wall (3)
block (1)
Project
Assets
Materials
ML-Agents
Prefabs
Scenes
s4 - One agent
s5-Test environment
s6 - Multiple agents PPO tra
s7 - avoid blocks
s8-Test environment
scripts
Car_Agent_s4
Car_Agent_s5
Car_Agent_s6
Car_Agent_s7
Car_Agent_s8
MobileRobot-497100
MobileRobot
Packages

4. Stop play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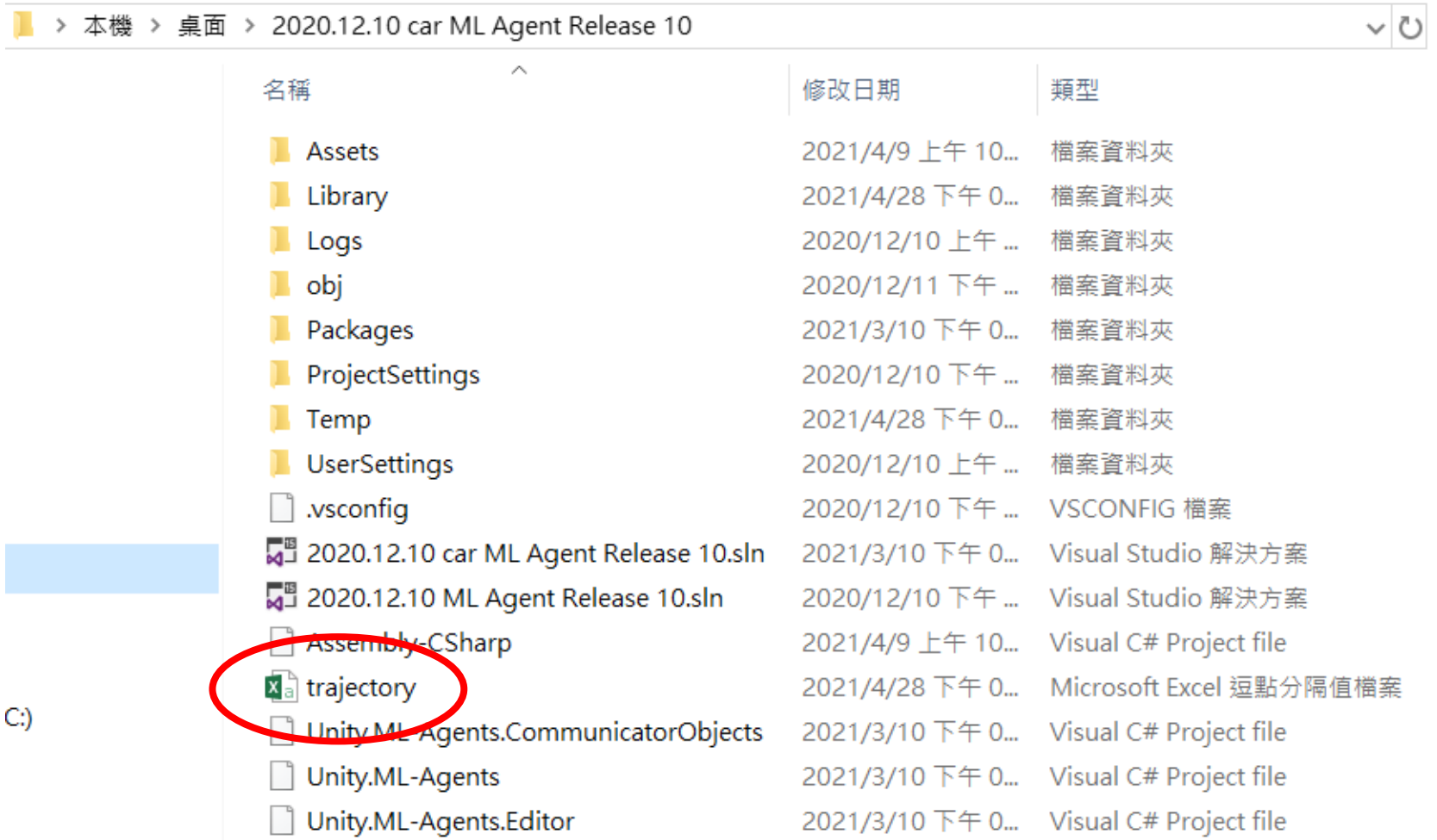
Car_Agent_s7
Car_Agent_s8
MobileRobot-497100
MobileRobot
Packages
Game
Display 1
Free Aspect
Scale
1x
Maximize On Play
Mute Audio
Stats

6. Find "trajectory.csv" file in Unity project folder



7. Test performance data

	A	B	C	D
1	time	x	y	reward
2	銖 ?05:21:10	0.63	-3.4565	-0.01
3	銖 ?05:21:10	0.627491	-3.42517	-0.01
4	銖 ?05:21:10	0.613262	-3.33416	-0.01
5	銖 ?05:21:10	0.599229	-3.24405	-0.01
6	銖 ?05:21:10	0.591125	-3.21271	-0.01
7	銖 ?05:21:10	0.584234	-3.18461	-0.01
8	銖 ?05:21:10	0.544194	-3.03687	-0.01
9	銖 ?05:21:10	0.525495	-2.96997	-0.01
10	銖 ?05:21:10	0.507234	-2.91972	-0.01
11	銖 ?05:21:10	0.465379	-2.81597	-0.01
12	銖 ?05:21:10	0.453885	-2.79267	-0.01
13	銖 ?05:21:10	0.431643	-2.75009	-0.015
14	銖 ?05:21:10	0.364092	-2.65532	-0.015
15	銖 ?05:21:10	0.355094	-2.64419	-0.015
16	銖 ?05:21:10	0.303738	-2.57338	-0.015

	A	B	C	D
343	銖 ?05:21:17	3.722431	1.007261	-0.01
344	銖 ?05:21:17	3.703396	1.087057	-0.01
345	銖 ?05:21:17	3.705435	1.07981	-0.01
346	銖 ?05:21:17	3.721862	0.983501	-0.005
347	銖 ?05:21:17	3.699896	1.052948	-0.01
348	銖 ?05:21:17	3.681983	1.114053	-0.01
349	銖 ?05:21:17	3.666118	1.167716	-0.01
350	銖 ?05:21:17	3.631492	1.275521	-0.01
351	銖 ?05:21:17	3.607999	1.339093	-0.01
352	銖 ?05:21:17	3.592808	1.398256	99.99
353	Finish No 1			
354	銖 ?05:21:17	0.63	-3.29618	-0.01
355	銖 ?05:21:17	0.630449	-3.30085	-0.01
356	銖 ?05:21:17	0.626995	-3.27256	-0.01

	A	B	C	D
678	銖 ?05:21:23	3.944816	1.172897	-0.005
679	銖 ?05:21:24	3.939992	1.189768	-0.005
680	銖 ?05:21:24	3.901663	1.315406	-0.01
681	銖 ?05:21:24	3.917924	1.264687	-0.005
682	銖 ?05:21:24	3.888138	1.348562	-0.01
683	銖 ?05:21:24	3.843864	1.426655	-0.01
684	銖 ?05:21:24	3.825451	1.461613	99.99
685	Finish No 2			
686				
687				
688				