



國立成功大學
National Cheng Kung University

114 學年度特殊選材獨立招生
資訊工程學系乙組 上機考試演練試題

施測日期：113 年 11 月 16 日

零、 程式語言與開發環境

一、 程式語言版本標準

本考試採 C、C++ 或 Python 命題，其版本如下表。

程式語言名稱	版本標準
C	ISO 9899:1999 (C99)
C++	ISO 14882:2017 (C++17)
Python	Python 3.10

二、 考試開發環境

開發環境版本如下。

軟體	版本
GNU C Compiler	9.4.0
Zenoh Router	0.11.0
Docker	24.0.7
Bourne-Again Shell	5.1.16
Operating System	Ubuntu 22.04
Docker image	Based on osrf/ros:humble-desktop
ROS 2	Humble

三、 整合開發環境

除試場電腦已安裝之軟體以外，考生不得自行安裝軟體於試場電腦，即僅准許使用試場電腦已安裝之軟體。

壹、 範例試題

一、 考生可透過資料夾內的 Dockerfile 來啟動環境來執行本演練試題。

二、 範例程式為使用 Zenoh 軟體框架實作簡易 IoT 系統。此演練試題會讓考生修正程式內的錯誤，並順利運行上述系統。

上述 IoT 系統，以四個 Zenoh 節點組成以及帶有 ROS Subscribe 作用的模擬手機，Zenoh 節點當中包含一個模擬監測器節點，以及三個模擬感測器節點。

感測器一為溫度感測器，其位置為 home/kitchen/sensor/temp。

感測器二為溫度感測器，其位置為 home/bedroom/sensor/temp。

感測器三為濕度感測器，其位置為 home/bedroom/sensor/humidity。

模擬監測器之功能，係用以監測上列三個感測器數值，同時能「即時」接收感測器資訊，並將之印出於標準輸出。模擬監測器除了印出感測器接收的即時資料功能之外，若是房間溫度、濕度及廚房溫度超出限制範圍或是低於限制範圍，模擬監測器會使用 ROS Publish 的方式將警告訊息傳遞至模擬手機當中，以達到警示作用。

範例程式碼包含三個模擬感測器實作，請考生連同下方指定參考文件仔細閱讀，並修正模擬監測器節點程式碼（monitor.py）中，無法執行之錯誤。

```
root@ubuntu22-System-Product-Name:/demo# sh start.sh
>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 62.28469314721972, timestamp: 1725983682.350617'), monitor timestamp: 1725983682.3529165
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/kitchen/sensor/temp': 'temperature: 26.583866317372387, timestamp: 1725983682.6018768'), monitor timestamp: 1725983683.377392
>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 59.95443101546786, timestamp: 1725983683.1017964'), monitor timestamp: 1725983683.37754
>> [Subscriber] Received PUT ('home/bedroom/sensor/temp': 'temperature: 26.29278188416077, timestamp: 1725983683.2011936'), monitor timestamp: 1725983683.3776888
>> [Subscriber] Received PUT ('home/kitchen/sensor/temp': 'temperature: 27.477151466346218, timestamp: 1725983683.60237'), monitor timestamp: 1725983683.604306
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 64.96017356952831, timestamp: 1725983683.8530486'), monitor timestamp: 1725983684.4918969
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/kitchen/sensor/temp': 'temperature: 28.28278632015927, timestamp: 1725983684.603391'), monitor timestamp: 1725983685.3867145
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 65.26094952671239, timestamp: 1725983684.604159'), monitor timestamp: 1725983686.267275
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/bedroom/sensor/temp': 'temperature: 27.1019290380069684, timestamp: 1725983684.803228'), monitor timestamp: 1725983687.1400466
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 60.065438116592996, timestamp: 1725983685.3552525'), monitor timestamp: 1725983688.368325
5
>> [Subscriber] Received PUT ('home/kitchen/sensor/temp': 'temperature: 27.9128332682101, timestamp: 1725983685.6043625'), monitor timestamp: 1725983688.3685064
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 58.30951349228429, timestamp: 1725983686.1064336'), monitor timestamp: 1725983689.2494397
>> [Subscriber] Received PUT ('home/bedroom/sensor/temp': 'temperature: 26.2127953608746, timestamp: 1725983686.4051516'), monitor timestamp: 1725983689.249603
>> [Subscriber] Received PUT ('home/kitchen/sensor/temp': 'temperature: 27.15734272540711, timestamp: 1725983686.605713'), monitor timestamp: 1725983689.249666
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 54.92388814821953, timestamp: 1725983686.857563'), monitor timestamp: 1725983690.1298575
>> [Subscriber] Received PUT ('home/kitchen/sensor/temp': 'temperature: 25.2627924559507, timestamp: 1725983687.6063843'), monitor timestamp: 1725983690.1300423
>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 58.69259626539224, timestamp: 1725983689.110392'), monitor timestamp: 1725983691.3896856
>> [Subscriber] Received PUT ('home/bedroom/sensor/temp': 'temperature: 26.366576113823356, timestamp: 1725983689.6084597'), monitor timestamp: 1725983691.3897226
>> [Subscriber] Received PUT ('home/kitchen/sensor/temp': 'temperature: 25.92732963849879, timestamp: 1725983689.609164'), monitor timestamp: 1725983691.3597836
>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 61.11732389576042, timestamp: 1725983689.861478'), monitor timestamp: 1725983691.3598237
>> [Subscriber] Received PUT ('home/kitchen/sensor/temp': 'temperature: 25.15376414376451, timestamp: 1725983690.6103408'), monitor timestamp: 1725983691.3598707
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 64.33529829999213, timestamp: 1725983690.6123862'), monitor timestamp: 1725983692.244693
Error occurred! Message sent to phone

>> [Subscriber] Received PUT ('home/bedroom/sensor/temp': 'temperature: 26.167112855951327, timestamp: 1725983691.2104223'), monitor timestamp: 1725983693.1224575
>> [Subscriber] Received PUT ('home/bedroom/sensor/humidity': 'humidity: 71.3018840828866, timestamp: 1725983691.3625104'), monitor timestamp: 1725983693.1226225

ubuntu22@ubuntu22-System-Product-Name: /demo$ cat phone_log
no log
[INFO] [1725983683.132041264] [listener: I heard: {f'Humidity over 62 degrees!'}]
[INFO] [1725983684.251748870] [listener: I heard: {f'Temperature over 26.8 degrees!'}]
[INFO] [1725983685.146700361] [listener: I heard: {f'Humidity over 62 degrees!'}]
[INFO] [1725983686.029093214] [listener: I heard: {f'Temperature over 26.8 degrees!'}]
[INFO] [1725983686.980253644] [listener: I heard: {f'Humidity over 62 degrees!'}]
[INFO] [1725983688.128734148] [listener: I heard: {f'Temperature over 26.8 degrees!'}]
[INFO] [1725983689.011515337] [listener: I heard: {f'Temperature over 26.8 degrees!'}]
[INFO] [1725983689.890318991] [listener: I heard: {f'Temperature over 26.8 degrees!'}]
[INFO] [1725983691.119471384] [listener: I heard: {f'Temperature over 26.8 degrees!'}]
[INFO] [1725983692.085202574] [listener: I heard: {f'Temperature under 25.2 degrees!'}]
[INFO] [1725983692.881797958] [listener: I heard: {f'Humidity over 62 degrees!'}]
[INFO] [1725983693.667754608] [rclcpp]: signal_handler(signal=2)
ubuntu22@ubuntu22-System-Product-Name: ~$
```



上圖為正常執行之後應當顯示之畫面，模擬監測器之輸出係依照程式執行的先後順序，而模擬手機中的接收訊息可在結束程式執行後，至目錄下的紀錄文件 (Phone.log) 當中進行查看。

試問：

1. 請問模擬監測器儲存各感測器之感測資訊是否會隨時間變化？
2. 如果要透過 C / C++/ Python 實作 ROS 的通訊方式，達到與程式相同的效果，並且能夠傳遞不同資料，應當如何實作？

請考生就上列二題審慎思考，並擬答之，對考試作答或有幫助。

貳、 指定參考文件 (考生應於試前閱讀之)

一、 C、C++ 及 Python 語言之 API 及字串函式庫之參考網站。

1. C 語言：<https://en.cppreference.com/w/c/language>
2. C++：<https://en.cppreference.com/w/cpp/language>
3. Python：<https://docs.python.org/3.10/>

二、 Zenoh 軟體框架之 API 文件

1. C 語言：<https://zenoh-c.readthedocs.io/en/0.11.0/>
2. C++：<https://zenoh-cpp.readthedocs.io/en/latest/>
3. Python：<https://zenoh-python.readthedocs.io/en/0.11.0/>

三、 ROS 2 相關文件

1. ROS 基礎概念：<https://docs.ros.org/en/humble/Concepts.html>
2. ROS 節點介紹：<https://docs.ros.org/en/humble/Nodes.html>

四、 連猴子都能懂的 Git 入門指南

1. <https://backlog.com/git-tutorial/tw/contents/>

參、 自行閱讀文件（鼓勵閱讀之）

一、 Bourne-Again Shell 文件

1. <https://linux.die.net/man/1/bash>

二、 GNU Compiler Collection 以及 GNU Make 文件

1. <https://gcc.gnu.org/onlinedocs/gcc-9.4.0/gcc/>

2. <https://www.gnu.org/software/make/manual/make.html>

3. <https://sourceware.org/gdb/current/onlinedocs/gdb.html/>

三、 Docker / 容器化文件

1. <https://www.youtube.com/watch?v=IXifQ8mX8DE>

2. <https://docs.docker.com/engine/reference/commandline/logs/>

四、 ROS 2 相關文件

1. <https://docs.ros.org/en/humble/>

肆、 考試規定

- 一、 本規則依大學法第二十四條第五項訂定之。
- 二、 考生應攜帶國民身分證、駕駛執照或有近期照片足資辨識之健保卡正本應試。未攜帶身分證明文件正本，又不能於考試結束之前送達者，其成績不予採計。
- 三、 考試，使用本系電腦教室電腦進行之。
鍵盤、滑鼠等外接設備，考生得自行攜帶之。但因聲響或其他因素，足生影響於他人者，應即停止使用。
有前項情形，經監試小組制止而不從者，得命出場。
- 四、 考試期間，不得與其他考生交談。
- 五、 考生得攜帶書本或使用網際網路資源協助作答，惟不得以任何方式與其他考生或試外人通訊。
- 六、 考試以線上評分系統（Online Judge）給分，考生不得同時提交多次作答以期公平。
- 七、 考生以阻斷式攻擊或他法，使評分系統做出不正評分或致使評分系統不能正常運作者，其分數不予採計並追究其刑事責任。
- 八、 國立成功大學招生考場規定與本考試不生衝突部分準用之。