# Cosc264 Assignment 1

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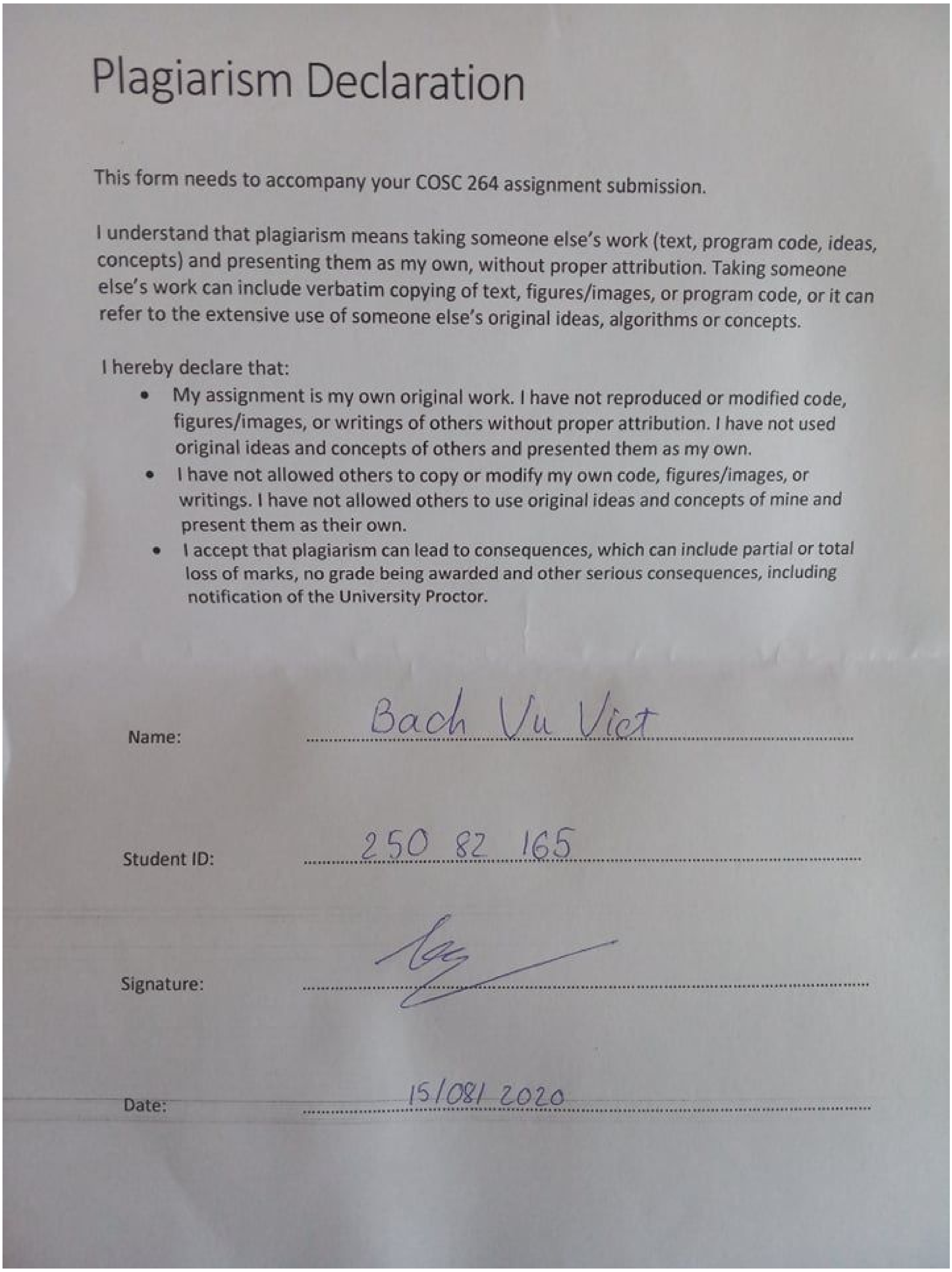
**Source included:**

- Plagiarism declaration (.pdf)
- packet.py: DT_Packet interface
- request.py: DT_Request class, to create requests -> bytearray
- response.py: DT_Response class, to decode bytearray received
- language.py: DT_Language class, support format server answer
- server.py: Program to be run on the host PC (always on)
- client.py: Program to be run on customer device (make 1 request at a time)

**Notes:**

- When create a DT_Packet, head_info are optional and assigned valude by class definition.
- When receive a DT_Packet, head_info must be not None to perform error checking, which come from static decoding method.



# Plagiarism Declaration

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| | |
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| Date: | 15/08/ 2020 |

```python
# Packet Interface (packet.py)
# Bach Vu
# 01/08/2020

from abc import abstractmethod

class DT_Packet:
    def __init__(self, packetType):
        self.MagicNum = 0x497E
        self.packetType = packetType

    @staticmethod
    def intToBinStr(decimal, str_len):
        return bin(decimal)[2:].zfill(str_len)

    @staticmethod
    def byteArrToInt(byte):
        return int.from_bytes(byte, byteorder="big")

    @staticmethod
    def DT_hex(num):
        return '0x000' + str(num)

    def isValid(self):
        """ Check conditions of a Packet Type """
        return self.header_errorCode()

    @abstractmethod
    def __repr__(self):
        """ Output log """

    @abstractmethod
    def header_errorCode(self):
        """ Check conditions of a Packet Type """

    @abstractmethod
    def encodePacket(self):
        """ Get the actual bytearray store data of this packet """

    @abstractmethod
    def decodePacket(packet):
        """ Turn bytearray to object """





```

```python
# Packet Structure (request.py)
# Bach Vu
# 01/08/2020

from packet import *

class DT_Request(DT_Packet):
    ErrorMessage = [
        "Expecting received packet have MagicNum 0x497E.",
        "Expecting received packet have packetType 0x0001.",
        "Undefined outupt Type [date/time]?",
        "Packet header is shorter than expected"
    ]
    def __init__(self, mode, head_info=None):
        self.requestType = mode # 0x0001 or 0x0002
        if head_info is None:
            super().__init__(0x0001)
        else:
            self.MagicNum   = head_info[0]
            self.packetType = head_info[1]

    def __repr__(self):
        out = "<Magic: {}> <packetType: {}> <requestType: {}>\n"
        out = out.format(hex(self.MagicNum), DT_Packet.DT_hex(self.packetType), 
DT_Packet.DT_hex(self.requestType))
        out += type(self).__name__ + " with request type: " + ("DATE" if self.requestType==1 
else "TIME")
        return out

    def header_errorCode(self):
        error_code = 0
        if self.MagicNum != 0x497E:
            error_code = 1
        elif self.packetType != 0x0001:
            error_code = 2
        elif self.requestType < 0x0001 or self.requestType > 0x0002:
            error_code = 3

        return error_code

    def encodePacket(self):
        # Error check
        check = self.isValid()
        if check != 0:
            return check

        # Header
        header = ""
        header += DT_Packet.intToBinStr(self.MagicNum,16)
        header += DT_Packet.intToBinStr(self.packetType,16)
        header += DT_Packet.intToBinStr(self.requestType,16)
        header  = int(header, 2).to_bytes(6, byteorder='big')

        # Pack
        packet = bytearray()
        packet += header
        return packet

    @staticmethod
    def decodePacket(packet):
        if len(packet) < 6:
            return 4

        magic    = DT_Packet.byteArrToInt(packet[0:2])
        packType = DT_Packet.byteArrToInt(packet[2:4])
        mode = DT_Packet.byteArrToInt(packet[4:6])
        requestPack = DT_Request(mode)

        # Error check
        param = [magic, packType]
        requestPack = DT_Request(mode, tuple(param))
        check = requestPack.isValid()
        if check != 0:
            return check
        return requestPack

```

```python
# Packet Structure (response.py)
# Bach Vu
# 01/08/2020

from packet import *
from datetime import datetime
from language import DT_Language

class DT_Response(DT_Packet):
    ErrorMessage = [
        "Expecting received packet have MagicNum 0x497E.",
        "Expecting received packet have packetType 0x0002.",
        "Undefined language outupt Type [Eng/Maori/Ger]?",
        "Year is over 2100. Data received must be invalid.",
        "Month is not between 1 and 12. Data received must be invalid.",
        "Day is not between 1 and 31. Data received must be invalid.",
        "Hour is not between 0 and 23. Data received must be invalid.",
        "Minute is not between 0 and 59. Data received must be invalid.",
        "Some data of displaying message is missing",
        "Packet header is shorter than expected"
    ]

    def __init__(self, language, mode, head_info=None):
        self.language = language

        if head_info is None:
            super().__init__(0x0002)
            now = datetime.now() # Time when obj created
            self.time = [now.year, now.month, now.day, now.hour, now.minute]
            dt = DT_Language(language, mode, self.time)
            self.message = dt.DTtoString().encode('utf8')
            self.m_len = len(self.message)
        else:
            self.MagicNum   = head_info[0]
            self.packetType = head_info[1]
            self.time       = head_info[2]
            self.message    = head_info[3]
            self.m_len      = head_info[4]

    def __repr__(self):
        out = "{}\n<Magic: {}> <packetType: {}> <lang: {}>\n<Time: {}> <MessLen: {}>"
        mess = type(self).__name__ + ": " + str(self.message, 'utf-8')
        return out.format(mess, hex(self.MagicNum),
                DT_Packet.DT_hex(self.packetType),
                DT_Packet.DT_hex(self.language),
                self.time, self.m_len)

    def header_errorCode(self):
        error_code = 0
        if self.MagicNum != 0x497E:
            error_code = 1
        elif self.packetType != 0x0002:
            error_code = 2
        elif self.language < 0x0001 or self.language > 0x0003:
            error_code = 3
        elif self.time[0] < 0 or self.time[0] > 2100:
            error_code = 4
        elif self.time[1] < 1 or self.time[1] > 12:
            error_code = 5
        elif self.time[2] < 1 or self.time[2] > 31:
            error_code = 6
        elif self.time[3] < 0 or self.time[3] > 23:
            error_code = 7
        elif self.time[4] < 0 or self.time[4] > 59:
            error_code = 8
        elif self.m_len != len(self.message):
            error_code = 9
        return error_code

    def encodePacket(self):
        """ Get the actual bytearray store data of this packet """
        # Error check
        check = self.isValid()
        if check != 0:
            return check

        # Header
        header = ""
        header += DT_Packet.intToBinStr(self.MagicNum,16)
        header += DT_Packet.intToBinStr(self.packetType,16)
        header += DT_Packet.intToBinStr(self.language,16)
        header += DT_Packet.intToBinStr(self.time[0],16)
        header += DT_Packet.intToBinStr(self.time[1],8)
        header += DT_Packet.intToBinStr(self.time[2],8)
        header += DT_Packet.intToBinStr(self.time[3],8)
        header += DT_Packet.intToBinStr(self.time[4],8)
        header += DT_Packet.intToBinStr(self.m_len,8)
        header  = int(header, 2).to_bytes(13, byteorder='big')

        # Pack
        packet = bytearray()
        packet += header
        packet += self.message
        return packet

    @staticmethod
    def decodePacket(packet, mode):
        if len(packet) < 13:
            return 10

        """ Turn bytearray to object """
        magic    = DT_Packet.byteArrToInt(packet[0:2])
        packType = DT_Packet.byteArrToInt(packet[2:4])
        language = DT_Packet.byteArrToInt(packet[4:6])
        year     = DT_Packet.byteArrToInt(packet[6:8])
        month    = DT_Packet.byteArrToInt(packet[8:9])
        day      = DT_Packet.byteArrToInt(packet[9:10])
        hour     = DT_Packet.byteArrToInt(packet[10:11])
        minute   = DT_Packet.byteArrToInt(packet[11:12])
        length   = DT_Packet.byteArrToInt(packet[12:13])

        time = [year, month, day, hour, minute]
        mess = packet[13:]

        # Error check
        param = [magic, packType, time, mess, length]
        responsePack = DT_Response(language, mode, tuple(param))
        check = responsePack.isValid()
        if check != 0:
            return check
        return responsePack
```

```python
# coding= utf-8
# DT Language Structure (language.py)
# Bach Vu
# 01/08/2020

from datetime import datetime

class DT_Language:
    def __init__(self, langMode, outputType, time):
        # (0x0001:Eng, 0x0002:Maori, 0x0003:Ger)
        self.language = langMode - 1
        self.mode = outputType - 1
        self.time = time
        self.stringFormats = [
            ["Today's date is {} {}, {}", "The current time is {:02d}:{:02d}"],
            ["Ko te ra o tenei ra ko {} {}, {}", "Ko te wa o tenei wa {:02d}:{:02d}"],
            ["Heute ist der {}. {} {}", "Die Uhrzeit ist {:02d}:{:02d}"]
        ]
        self.Months = [
            ["January", "February", "March", "April", "May", "June", "July", "August", "September", "October", "November", "December"],
            ["Kohitātea", "Hui-tanguru", "Poutū-te-rangi", "Paenga-whāwhā", "Haratua", "Pipiri", "Hōngongoi", "Here-turi-kōkā", "Mahuru", "Whiringa-ā-nuku", " Whiringa-ā-rangi", "Hakihea"],
            ["Januar", "Februar", "März", "April", "Mai", "Juni", "Juli", "August", "September", "Oktober", "November", "Dezember"]
        ]

    def DTtoString(self):
        day, month, year = self.time[2], self.time[1], self.time[0]
        hour, minute = self.time[3], self.time[4]
        output = self.stringFormats[self.language][self.mode]
        if self.mode == 0:
            month_str = self.Months[self.language][month-1]
            if self.language != 2:
                output = output.format(month_str, day, year)
            else:
                output = output.format(day, month_str, year)
        elif self.mode == 1:
            output = output.format(hour, minute)
        return output

def test():
    dt = [2020,8,8,7,0]
    lang1 = DT_Language(0x0001, 0x0001, dt)
    print(lang1.DTtoString())
    lang1 = DT_Language(0x0001, 0x0002, dt)
    print(lang1.DTtoString())
    lang1 = DT_Language(0x0002, 0x0001, dt)
    print(lang1.DTtoString())
    lang1 = DT_Language(0x0002, 0x0002, dt)
    print(lang1.DTtoString())
    lang1 = DT_Language(0x0003, 0x0001, dt)
    print(lang1.DTtoString())
    lang1 = DT_Language(0x0003, 0x0002, dt)
    print(lang1.DTtoString())

if __name__ == "__main__":
    test()

```

```python
# Server Application (server.py)
# Bach Vu
# 01/08/2020

from request import *
from response import *
from socket import *
import sys, select

class DTServer():
    def __init__(self, hostname):
        self.sockets = [["English","Maori","German"], [None,None,None]]
        self.requests = [] # (byte_array, output_lang, sender_ip)
        self.hostName = hostname
        print("Server started with host name '{}'".format(hostname))

    def createSocket(self, ports):
        try:
            for i in range(3):
                sock = socket(AF_INET, SOCK_DGRAM)
                sock.bind((self.hostName, ports[i]))
                self.sockets[1][i] = sock
                print("Port {} is ready to receive {} requests".format(ports[i],
self.sockets[0][i]))
            return True
        except Exception as e:
            raise e

    def shutdown(self):
        for socket in self.sockets[1]:
            socket.close()

    def getRequest(self):
        # get socket has buffer increase (new request)
        readable, _, _ = select.select(self.sockets[1], [], [])
        for sock in readable:
            option = -1
            if sock is self.sockets[1][0]:
                option = 0  # 0x0001 for English
            elif sock is self.sockets[1][1]:
                option = 1  # 0x0002 for Maori
            elif sock is self.sockets[1][2]:
                option = 2  # 0x0003 for German
            data, ip_sender = self.sockets[1][option].recvfrom(1024) # in byte
            self.requests.append( (data, option+1, ip_sender) )

    def sendResponse(self, response, target, s_ID):
        packet = response.encodePacket()
        if isinstance(packet, bytearray):
            socket = self.sockets[1][s_ID]
            socket.sendto(packet, target)
            print("Responded to sender at: {}".format(target))
        else:
            print("Respond failed with code {}! Try again ... ".format(packet))

####################### Main Program #################
def mainloop(server):
    while True:
        print("\nWaiting DT_request")
        server.getRequest()
        while len(server.requests) > 0:
            # Receive request
            packet = server.requests.pop(0)
            request = DT_Request.decodePacket(packet[0])
            if isinstance(request, int):
                err = "A request discarded with error Code {}:\n{}"
                err_mess = DT_Request.ErrorMessage[request-1]
                print(err.format(int(request), err_mess))
                continue
            print(request)

            # Reply
            print("Preparing response in {}.".format(server.sockets[0][packet[1]-1]))
            response = DT_Response(packet[1], request.requestType)
            server.sendResponse(response, packet[2], packet[1]-1)

def checkInputArgv():
    if len(sys.argv) != 4:
        return 1

    ports = []
    try:
        ports = [int(sys.argv[1]), int(sys.argv[2]), int(sys.argv[3])]
    except BaseException:
        return 2

    for port in ports:
        if port < 1024 or port > 64000:
            return 3
    return 0

def startServer():
    print("\nWelcome to DT Finder (Server)")
    # Error Checking
    errMess = [
        "Argument input error.\n    python server.py {host} {port_eng} {port_maori} {port_ger}",
        "Ports input must be integer (whole number).",
        "Port must be between 1024 and 64000 inclusively!"
    ]
    errCode = checkInputArgv()
    if errCode != 0:
        print(errMess[errCode-1])
        sys.exit()

    # Create Server instance
    host = getfqdn()
    ports = [int(sys.argv[1]), int(sys.argv[2]), int(sys.argv[3])]
    server = DTServer(host)
    server.createSocket(ports)
    return server

if __name__ == "__main__":
    try:
        DT_server = startServer()
        mainloop(DT_server)
    except KeyboardInterrupt:
        DT_server.shutdown()
        print("Program exited!")
    except Exception as e:
        print(e)
        print()
```

```python
# Client Application (client.py)
# Bach Vu
# 01/08/2020

from request import *
from response import *
from socket import *
import sys, select

class DTClient():
    def __init__(self, hostname, port):
        self.socket = socket(AF_INET, SOCK_DGRAM)
        self.socket.setblocking(0)
        self.target = None
        try:
            hostname = getaddrinfo(hostname, port)[0][4][0]
            self.target = (hostname, port)
        except Exception as e:
            raise e

    def postRequest(self, request):
        packet = request.encodePacket()
        if isinstance(packet, bytearray):
            self.socket.sendto(packet, self.target)
            print("Request sent to {}:{}! Waiting for response ... ".format(self.target[0],
self.target[1]))
        else:
            print("Request sent failed with code {}! Try again ... ".format(packet))

    def getResponse(self):
        ready = select.select([self.socket], [], [], 1)
        if ready[0]:
            data, addr = self.socket.recvfrom(1024)
            return data
        return None

################## Main Program ##################
def main():
    print("\nWelcome to DT Finder (Client)")
    # Error Checking
    errMess = [
        "Argument input error.\n    python client.py {mode} {host_target}
{port_eng/maori/ger}",
        "Ports input must be integer (whole number).",
        "Port must be between 1024 and 64000 inclusively!",
        "mode must be 'time' or 'date'."
    ]
    errCode = checkInputArgv()
    if errCode != 0:
        print(errMess[errCode-1])
        sys.exit()

    # Request
    host, port = sys.argv[2], int(sys.argv[3])
    DT_client = DTClient(host, port)
    mo = 1 if sys.argv[1] == 'date' else 2
    request = DT_Request(mo)
    DT_client.postRequest(request)

    # Response
    response = DT_client.getResponse()
    if not response: # None type
        print("We received no data after 1sec (time-out).\n")
        return
    response = DT_Response.decodePacket(response, mo)

    if isinstance(response, int):
        err = "A response discarded with error Code {}:\n{}\n"
        err_mess = DT_Response.ErrorMessage[response-1]
        print(err.format(response, err_mess))
    elif response:
        print(response)
        print()

def checkInputArgv():
    if len(sys.argv) != 4:
        return 1

    mode = sys.argv[1]
    try:
        port = int(sys.argv[3])
    except BaseException:
        return 2

    if port < 1024 or port > 64000:
        return 3
    if mode != "date" and mode != "time":
        return 4
    return 0

if __name__ == "__main__":
    try:
        main()
    except Exception as e:
        print(e)
        print("Program exited unexpectedly.\n")

```