SINGAPORE POLYTECHNIC **ET1205**

2015/2016 SEMESTER ONE EXAMINATION

Diploma in Engineering with Business
3rd Year Full Time

WIRELESS TECHNOLOGY APPLICATIONS Time Allowed: 2.0 Hours

Instructions to Candidates

1. The examination rules set out on the last page of the answer booklet are to be complied with.

2. This paper consists of **TWO** sections :

Section A	-	10 Multiple Choice Questions, 2 marks each.
Section B	-	8 Short Questions, 10 marks each.

3. **ALL** questions are **COMPULSORY**.

4. All questions are to be answered in the answer booklet. Start each question in Sections B on a new page.

5. Fill in the Question Numbers, in the order that they were answered, in the boxes found on the front cover of the answer booklet under the column "Question Answered".

6. This paper consists of 12 pages.

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SECTION A

MULTIPLE CHOICE QUESTIONS [2 marks each]

1. Please **tick** your answers in the **MCQ box** behind the front cover of the answer booklet.
2. No marks will be deducted for incorrect answers.

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1. Which one of the following wireless technologies is being used for the attendance taking system (ATS) in Singapore Polytechnic to record the attendance of students with their smart phones?

   (a) 3G or 4G
   (b) Wireless LAN
   (c) Radio Frequency Identification
   (d) Bluetooth

2. Which one of the following frequency bands has low signal attenuation and is able to transmit wireless signals as ground waves?

   (a) Low Frequency (LF)
   (b) High Frequency (HF)
   (c) Ultra High Frequency (UHF)
   (d) Super High Frequency (SHF)

3. Which one of the following options is described the anti-collision feature of the RFID technology?

   (a) Able to read same types of multiple tags without errors
   (b) Able to read different types of multiple tags without errors
   (c) Able to read from tags to tags without errors
   (d) Able to read from readers to readers without errors

4. Which one of the following options is one of the RFID applications used to monitor and prevent the unauthorized sign out of books in a library?

   (a) Emergency Asset Tracking System
   (b) Electronic Asset Servicing System
   (c) Electronic Article Surveillance System
   (d) Electrical Artificial Surveillance System

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5. Which one of the following entities integrates wired and wireless connection to provide internet access for the users in WLAN IEEE802.11 systems?

   (a) DS and ESS
   (b) AP and STA
   (c) Portal
   (d) BSS and ESS

6. Which one of the following frequency bands is used internationally for ZigBee technology?

   (a) 5.2 GHz band
   (b) 2.4 GHz band
   (c) 900 MHz band
   (d) 800 MHz band

7. Which one of the following features in Bluetooth is reduced the effects of interference between Bluetooth and other wireless technologies such as WLAN and ZigBee?

   (a) Adaptive frequency hopping
   (b) Adaptive battery control
   (c) Adaptive bust profile
   (d) Adaptive modulation

8. In GSM 900, the MS transmit in 890 to 915 MHz frequency range and the BTSs transmit in 935 to 960 MHz frequency range. What is the reason for uplink frequency is lower than downlink frequency?

   (a) MS is movable.
   (b) BTSs are fixed.
   (c) MS is powered by battery.
   (d) BTSs are larger than MS.

9. Which one of the following is the function provided by the MAC convergence sublayer of IEEE 802.16 WiMAX?

   (a) Provides subscribers with privacy
   (b) Enables very high bit rate data transmission
   (c) Enables low latency real-time traffic
   (d) Formats SDUs from the upper layers according to MAC PDU format

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10. Which one of the following options is one of the important factors to be included in wireless site survey for building a Wireless Infrastructure for Business?

    (a) Developing the sensible work plan
    (b) Determining the existence of interference sources
    (c) Implementing the user training
    (d) Performing a limited trial

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SECTION B [80 Marks]

B1. Figure B1 shows the signal waveform with the binary bit pattern $(001011011)_b$ which was transmitted from an RFID tag to the reader in an RFID Item Management system. The RF carrier frequency used in this system is 920 MHz.

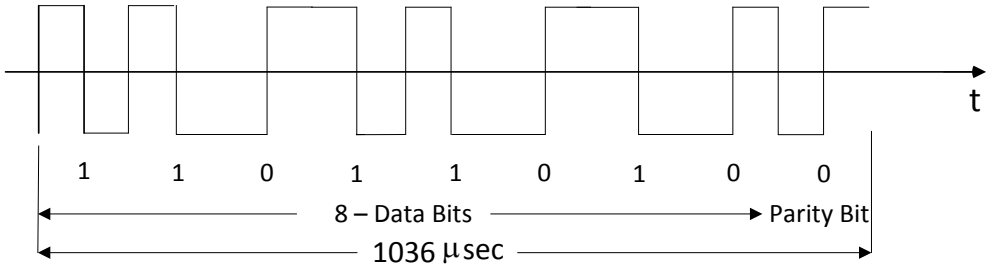

Figure B1

(a) State the type of signal coding methods used in the signal waveform shown in Figure B1. Why this coding was used from the tag to the reader?

(2 marks)

(b) Which type of parity error detection method was used in this system?

(1 mark)

(c) Determine the bit rate of the data in bits per second (bps).

(2 marks)

(d) What is the frequency band used in the system and what is the typical maximum reading range of this frequency band?

(2 marks)

(e) State two advantages of passive tag over the active tag.

(2 marks)

(f) State the main difference between the passive tag and the semi-passive tag.

(1 mark)

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B2. Figure B2 shows an Extended Service Set (ESS) with Distribution System (DS) for IEEE 802.11 WLAN standard.

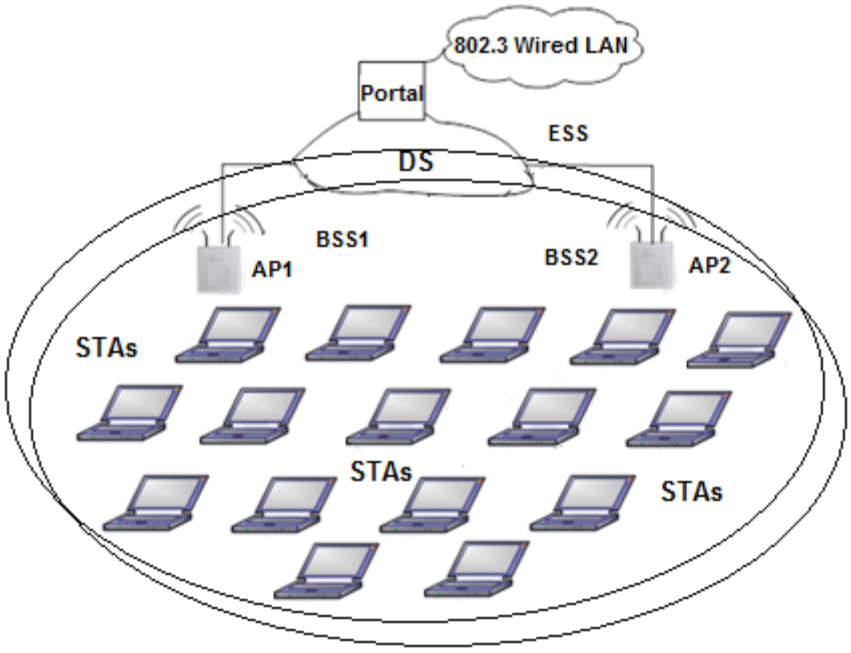

Figure B2

(a) Among the IEEE 802.11a, IEEE 802.11b and IEEE 802.11g, which standards operate in the 2.4 GHz ISM band?

(2 marks)

(b) State the no. of channels available in 2.4 GHz ISM band for WLAN IEEE 802.11 and bandwidth of each channel in MHz.

(2 marks)

(c) There are 4 different types of ESS configurations possible; namely *partially overlap BSSs*, *physically disjointed BSSs*, *physically co-located BSSs* and *co-existence of other IBSS or ESS networks*. What ESS configuration is represented by AP1 and AP2?

(1 mark)

(d) Which WLAN devices found in Figure B2 are to provide the interconnection between DS and BSS?

(1 mark)

(e) Which entity found in Figure B2 to provide the routing of packets from one AP to another AP to communicate seamlessly among all the STAs at different BSSs?

(1 mark)

(f) Of the three IEEE 802.11 variants – IEEE 802.11a, IEEE 802.11b and IEEE 802.11g – which of them:

(i) has the shortest range,
(ii) has the lowest bit rate,
(iii) combines the best features of the other two variants?

(3 marks)

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B3. Figure B3 shows one of the ZigBee applications used in a **Smart City** to monitor of temperature and humidity of the location and control the street light.

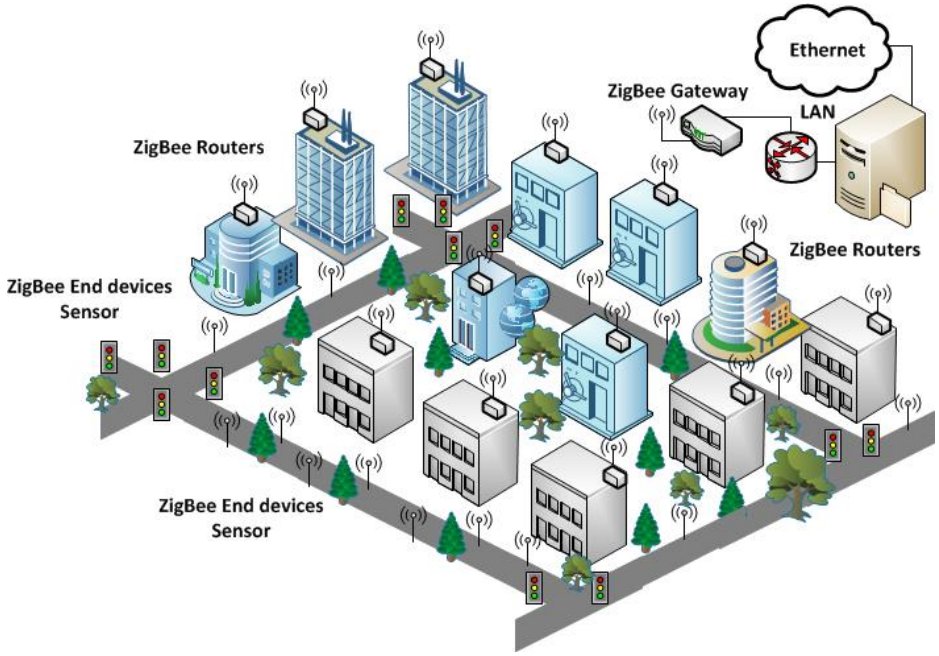

Figure B3

(a) Which IEEE 802 standard describes the physical and MAC layers in the ZigBee wireless technology? (1 mark)

(b) Name the organization/promoter who builds on IEEE 802 standard and defines the network and application layers in the ZigBee wireless technology. (1 mark)

(c) List the any two advantages for using ZigBee wireless technology in the above application. (2 marks)

(d) How many radio frequency channels are available in 2.4 GHz ISM band for ZigBee wireless technology? (1 mark)

(e) What are the two types of hardware devices available in the ZigBee technology? (2 marks)

(f) Which hardware device is used as the ZigBee gateway? (1 mark)

(g) Which hardware device is used as the ZigBee router? (1 mark)

(h) Which hardware device is used as the ZigBee Sensor? (1 mark)

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B4. Figures B4 shows the timing diagram of transmitted packets among a master Bluetooth device and two Bluetooth slaves.

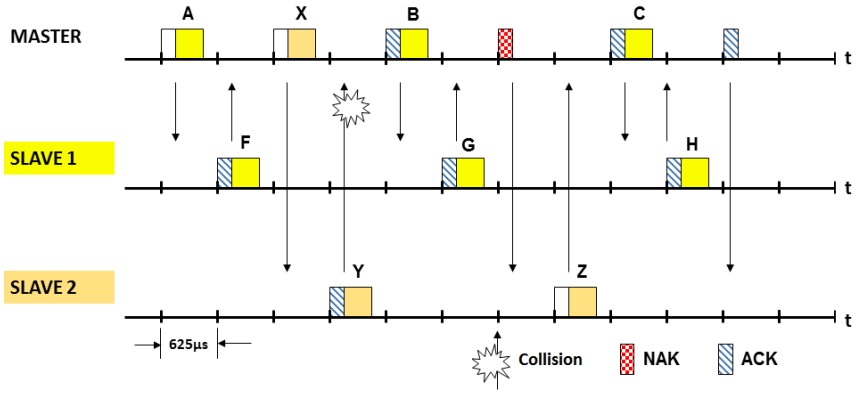

Figure B4

(a) What is the packet size (in number of slots) used in the above Bluetooth transmission?

(1 mark)

(b) Name the network topology given in Figure B4 for the Bluetooth technology.

(1 mark)

(c) Which type of the physical links was used between the Bluetooth master device and slave 1 in Figure B4?

(1 mark)

(d) Name the **retransmitted packet from the slave 2** to the master Bluetooth device during the above transmission due to collision.

(1 mark)

(e) What is the maximum number of links **for audio** in Bluetooth that a master device can support?

(1 mark)

(f) Name one of the applications that uses File Transfer Profile in Bluetooth Technology.

(1 mark)

(g) Name one of the applications that uses Human Interface Device Profile in Bluetooth Technology.

(1 mark)

(h) Name one of the applications that use Advanced Audio Distribution Profile in Bluetooth.

(1 mark)

(i) Frequency hopping spread spectrum (FHSS) is used in the Bluetooth technology. If the **three** slot packet is used, what is the number of hops in one second between the master and slave to change frequencies?

(1 mark)

(j) What is the reason for the time gap required between time slots of master and slave during transmission?

(1 mark)

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B5. Figures B5.1 and B5.2 show all the possible states of the Bluetooth link controller for the Bluetooth technology and the relationship among Bluetooth profiles as listed in the Bluetooth profile specification respectively.

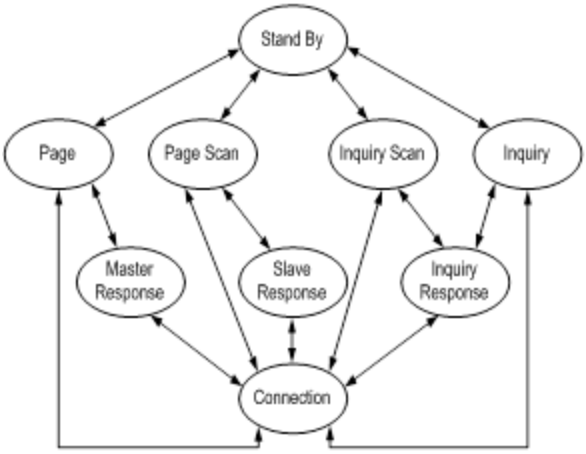
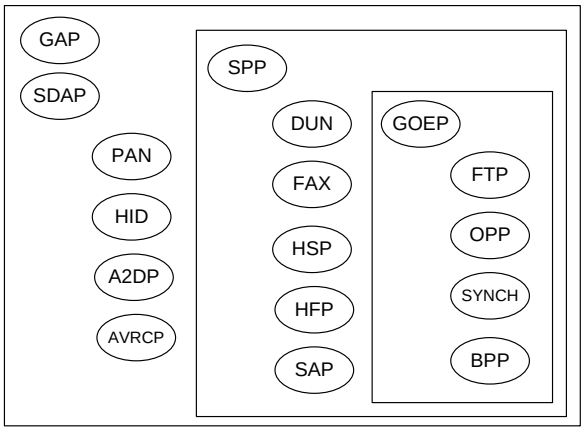


Figure B5.1



Relationship among Bluetooth Profiles

Figure 5.2

(a) If a Bluetooth device likes to discover other Bluetooth-enabled devices within its RF range, what is the state of the Bluetooth **inquirer** to be?

(1 mark)

(b) If a Bluetooth device likes to discover other Bluetooth-enabled devices within its RF range, what is the state of the Bluetooth **inquiry scanner** which transmits an FHS packet, to be?

(1 mark)

(c) Name the three procedures that are involved in establishing a connection between a Bluetooth master and a Bluetooth slave?

(3 marks)

(d) When a Bluetooth device is connected to a master Bluetooth device, name one of the possible modes for the slave that actively participates in the piconet.

(1 mark)

(e) Name the one of the possible modes for the slave that listens to piconet master at reduces rate to use less power.

(1 mark)

(f) Name all the profiles that require for synchronizing personal data between two Bluetooth enable devices.

(3 marks)

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B6. Figure B6.1 and B6.2 show the physical layer and MAC sub layers of the WiMAX technology and the network architecture of the WiMAX technology.

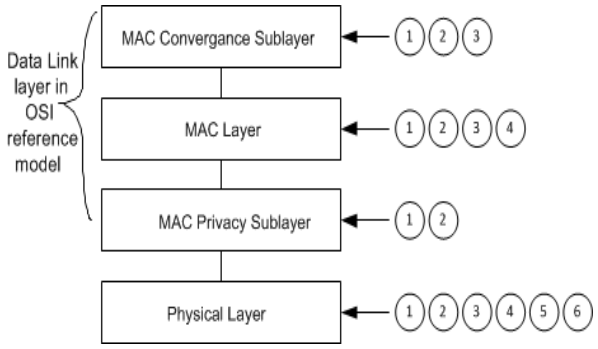

Figure B6.1

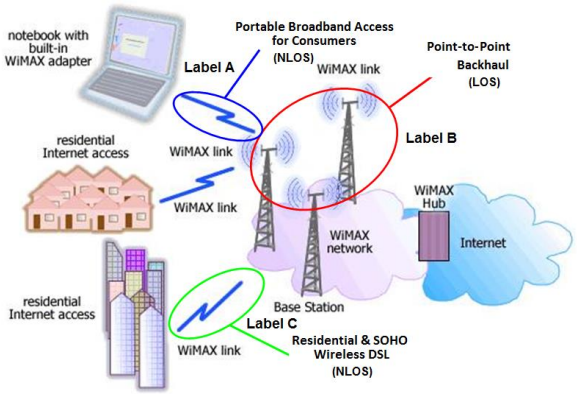

Figure B6.2

(a) Name any two functions of the Physical layer.

(2 marks)

(b) Name any two functions of the MAC layer.

(2 marks)

(c) Which relevant layer performs the authentication of a legitimate user in WiMAX network?

(1 mark)

(d) Which standard is used to connect between the WiMAX gateways and the mobile users?

(1 mark)

(e) Which standard is used to connect between the Internet backbone and the WiMAX gateways?

(1 mark)

(f) What is the frequency range of WirelessMAN-SC?

(1 mark)

(g) Briefly describe the feature of Dynamic Frequency Selection (DFS) found in WiMAX IEEE 802.16a and what its benefit is?

(2 marks)

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B7. Figures B7.1 and B7.2 show the three main sections of 2.5G, "GPRS" and 3G, "UMTS" architectures respectively.

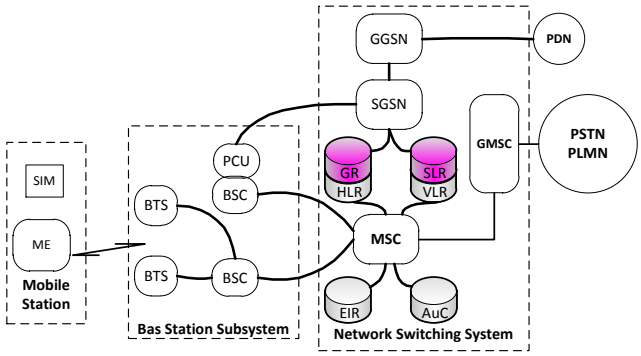

Figure B7.1

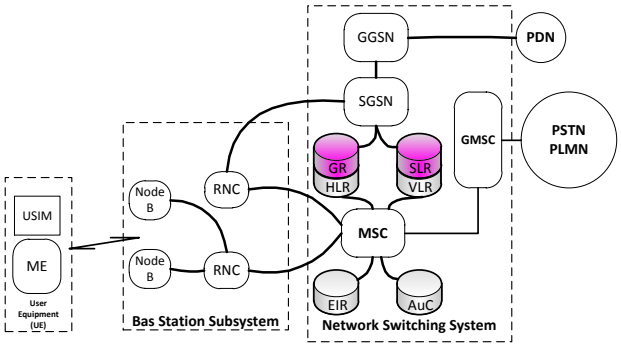

Figure B7.2

(a) By comparison between two architectures, which of the subsystems were required to make changes from 2.5G to 3G?

(2 marks)

(b) Which of the network components in 2.5G requires to be changed to user equipment in 3G?

(1 mark)

(c) Which of the network components in 2.5G requires to be changed to Node B in 3G?

(1 mark)

(d) Which of the network components in 2.5G requires to be changed to RNC in 3G?

(1 mark)

(e) What is the air interface used in 2.5G between MS and BTS?

(1 mark)

(f) What is the air interface used in UMTS between UE and Node B?

(1 mark)

(g) Which functional block in UMTS measures the signal quality and performs inner loop power control?

(1 mark)

(h) State one of the similarities between the BTS in 2.5G and Node B in 3G?

(1 mark)

(i) State one of the differences between the BSC in 2.5 G and RNC in 3G?

(1 mark)

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B8. There is a need to set up an attendance taking system using **smart phones** for an educational institution with more than 1000 staff and more than 10,000 students to enhance the business opportunities of all the stakeholders. Figure B8 shows the **sample** architecture of the **proposed system**.

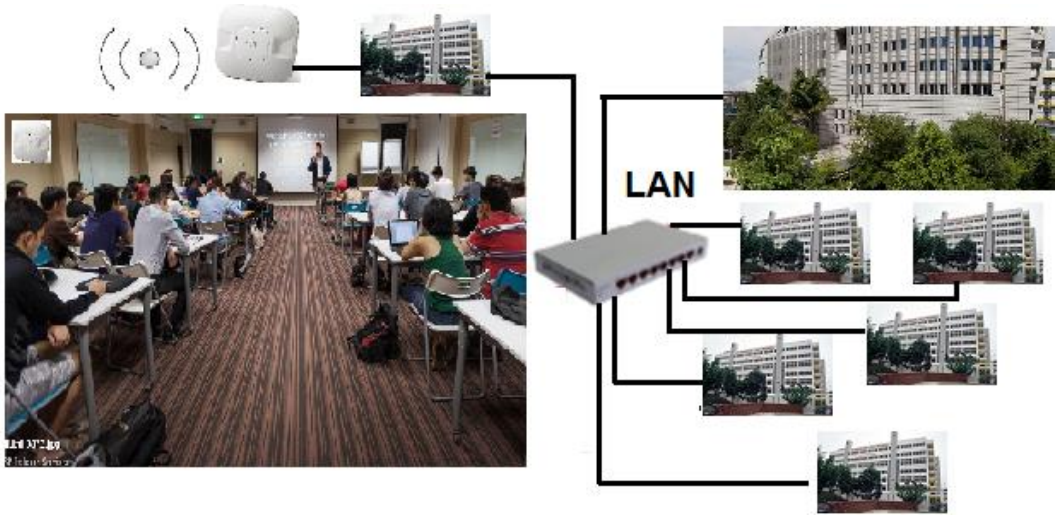

Figure B8

(a) Name the suitable wireless technology that is required to be used in the campus for this proposed system.

(1 mark)

(b) After the organisational assessment is done, what will be the next step to set up this wireless infrastructure?

(1 mark)

(c) List any two possible questions that you can ask to find out the information of the present system.

(2 marks)

(d) **Different industries** often have different network requirements. What should be the major network requirement for the educational institution to implement the wireless system?

(1 mark)

(e) Which type of documents should be sent to the vendor when a sensible work plan is completed?

(1 mark)

(f) Name any two of recurring costs of the ROI calculation that involve setting up a wireless network.

(2 marks)

(g) Which group of people should be involved in the planning process to get their unbiased perspective view?

(1 mark)

(h) When should be performed a limited trial or a pilot project?

(1 mark)

****** END OF PAPER ******

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