

Indian Institute of Technology Bombay
IDP in Educational Technology
Instructor Resources

Resource – <i>Peer Instruction Activity constructor</i>	Version 1.0, Feb 2014
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Constructing Peer-Instruction questions of various types for different purposes

Peer-Instruction questions can have a variety of goals, and can be formed using different pedagogical strategies. Questions below contain different possible goals and instructor can have. The questions also contain brief ‘how-tos’ for writing Peer-Instruction questions for each goal.

Part 1 – Plan your PI activity

1. Choose a subject and topic that you will be taking in the next/current semester.

Subject: Digital Communication

Topic: Spread Spectrum, TDMA and FDMA

Part 2 – Type of PI Instruction

For each goal given below, write a Peer-Instruction question in your chosen topic. Each question must contain the question ‘stem’ along with 3-5 choices. See examples on slides of “*Online_PeerInstruction_Set3.pdf*” in the section “Types of Peer-Instruction questions” and “When to use Peer-Instruction questions”.

A. Goal: Conceptual reasoning “one right answer” questions.

How to write the PI question: Write conceptual questions which can be answered using verbal arguments, logical reasoning, proportional relationships, and so on. Avoid questions that need numerical calculations.

Examples (note that these are merely ideas – you have to write the full question and choices):

Describe a scenario such as a process or a phenomenon. Ask what would happen to the objects in the scenario or the variables in the process if a certain stimulus were applied.

- Does it increase / decrease / stay same?
- Move left / right?
- Compare A & B –which is greater /less same?

This set of Digital Communication focuses on “Spread Spectrum, TDMA and FDMA”.

1. In which modulation schemes, the spreading of spectrum occurs?

- a) Frequency modulation
- b) Amplitude modulation
- c) Frequency & Amplitude modulation
- d) None of the mentioned

Answer: A

Explanation: In modulation schemes such as frequency modulation and pulse code modulation spreading of spectrum occurs but it cannot be considered as types of spread spectrum technique.

B. Goal: Discussion “no one right answer” questions

How to write the PI question: Write questions which genuinely admit multiple possible answers, say while making design choices, modeling systems.

Examples (note that these are merely ideas – you have to write the full question and choices):

- If you could choose only one X, which would it be?
- What do you think is the reason for Y?
- If you had to make a decision for Z, what would it be?

Gaussian noise has _____ power spread _____ over all frequencies.

- a) Zero, uniformly
- b) Zero, non uniformly
- c) Infinite, uniformly
- d) Infinite, non uniformly

Answer: c

Explanation: Gaussian noise is a mathematical model which has infinite power spread uniformly over all frequencies.

C. Goal: Predict an outcome (e.g., of an experiment, or a program)

How to write the PI question: Describe the experiment. You can partially show it (not the result) using a demo, video, simulation. Ask students to predict what would happen if something were changed. Choices should indicate specific possible outcomes.

Examples: If P were changed, what would happen to Q? (You can ask along following parameters) (*note that these are merely ideas – you have to write the full question and choices*):

- i) ...becomes bigger/ smaller
- ii) ... changes brightness – increase / decrease / stay same
- iii) ... changes shape to A / B / C
- iv) ... moves along path A/ B/ C ...

After voting, during discussion phase, ask students to give reasons along with their choices. These are excellent questions to elicit students' wrong reasoning patterns.

Jamming is caused by

- a) Multipath
- b) Natural phenomena
- c) Multipath & Natural phenomena**
- d) None of the mentioned

Answer: c

Explanation: Jamming can be caused by natural phenomenon and also is caused by multipath.

D. Goal: Embed reasoning in answers

How to write the PI question: The question describes a phenomenon or a situation. Choices include not just what happens but also possible reasons including plausible but wrong reasons. Different choices can correspond to multiple reasons for the same outcome.

Examples (note that these are merely ideas – you have to write the full question and choices):

- ...slower since gravity is acting against it;
- ... slower since there is friction

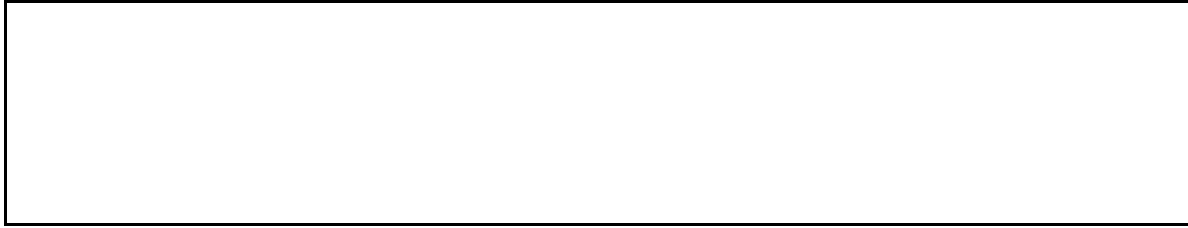
EMBED REASONIG: https://youtu.be/AKXFwwcww_E

In spread spectrum technique, the desired signal is multiplied _____ and interference signal is multiplied _____

- a) Once, twice
- b) Twice, once**
- c) Twice, thrice
- d) Thrice, twice

Answer: b

Explanation: In spread spectrum technique, the desired signal is multiplied twice and interference signal is multiplied once.

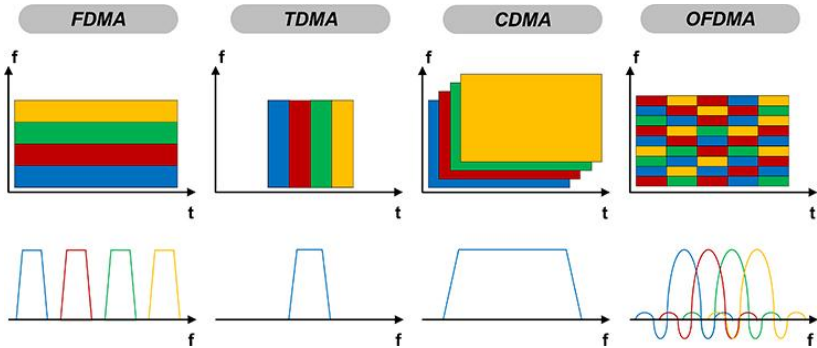


E. Goal: Reason using representations

How to write the PI question: Give one representation of a scenario or a process. Ask students which of the choices best describes it in a different representation. The question as well as the choices could contain different representations such as diagrams, graphs, equations, words.

Examples (note that these are merely ideas – you have to write the full question and choices):

- Which graph best represents the equation?
- For the given configuration, what is the pattern of variable X?
- What is happening to variable Y at this point in the graph?

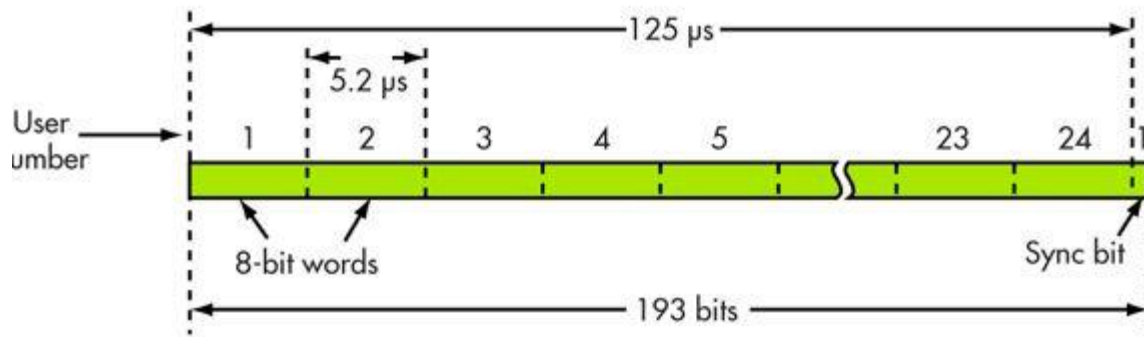


Why CDMA is used for most of the data communication?

In CDMA technology, More security is provided as compared with the GSM technology because encryption is inbuilt in the CDMA. ... The signal cannot be traced easily in CDMA as compared to the signals of GSM, which are concentrated in the narrow bandwidth. Therefore, the CDMA phone calls are more secure than the GSM calls.

F. Goal: As a stepping stone to problem-solving

How to write the PI question: The goal of this PI question is to help students through the steps of a complex problem without solving it for them yourself. Break up the analytical problem into steps. Convert one or more step into a PI question. This step can involve choice of principles needed to solve the problem, drawing graphs / diagrams needed to solve the problem, setting up of the mathematical equations, etc. See the example of the mid-sem question in main workshop slides, how it was converted from a full problem to a series of PI questions.



This T1 digital telephony frame illustrates TDM and TDMA. Each time slot is allocated to one user. The high data rate makes the user unaware of the lack of simultaneity.

Solution with the help of previous graph and videos.

The digitized voice appears as individual serial bytes that occur at a 64-kHz rate, and 24 of these bytes are interleaved, producing one T1 frame of data. The frame occurs at a 1.536-MHz rate (24 by 64 kHz) for a total of 192 bits. A single synchronizing bit is added for timing purposes for an overall data rate of 1.544 Mbits/s. At the receiving end, the individual voice bytes are recovered at the 64-kHz rate and passed through a digital-to-analog converter (DAC) that reproduces the analog voice.

G. Goal: Recall point from previous lecture

How to write the question. These are easier questions than some of the above. The goal is to recap ideas from the previous lecture which are needed in today's class. Give as opening activity of a class. Can replace traditional "Summary of last class" slide. Helpful in getting students to settle down. In the question, ask students to identify definition or give straightforward application of concepts.

1. **Explanation:** In modulation schemes such as frequency modulation and pulse code modulation spreading of spectrum occurs but it cannot be considered as types of spread spectrum technique.
2. **Explanation:** Gaussian noise is a mathematical model which has infinite power spread uniformly over all frequencies.
3. **Explanation:** Jamming can be caused by natural phenomenon and also is caused by multipath.
4. **Explanation :** In spread spectrum technique, the desired signal is multiplied twice and interference signal is multiplied once.

H. Goal: Survey questions / personal opinion

How to write such PI questions: Use such questions as -

- a) a means to get group information about the class (*Examples:* how many know programming to level X, level Y ...)
- b) feedback for instructor on own teaching practice (*Examples:* pace too fast/ slow, exam difficult/ easy, last lecture understood / not)
- c) get an opinion of what students think about an open-ended issue (*Examples:* energy, climate change, policy ...)

Can you able to understand the basics of digital communication?

Did you able to understand the deference between the noise and interference?

Could you differentiate different multiple access techniques FDMA TDMA CDMA ?

Did you understand why CDMA is used for the communication ?

Part 3 – Challenges, Best Practices and Resources

Refer to the slide “Online_PeerInstruction_Set5.pdf”

Part 4 (Optional): Conduct an education research study

If you are interested in determining the effectiveness of your implementation, beyond informally asking a few students for their opinion, then contact convener.et@iitb.ac.in . Research scholars from the IDP-ET will be happy to work with you to structure an education research study for your PI activity.