Fís Foghlaim Forbairt

PDST

Professional Development Service for Teachers | An tSeirbhís um Fhorbairt Ghairmiúil do Mhúinteoirí

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LEAVING CERTIFICATE
COMPUTER SCIENCE

National Workshop 1

PDST

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Session 4

From a learning to a teaching perspective

Schedule

Part 1	Reflection
Part 2	Learning challenges faced by novice programmers
Part 3	High School Scenario
Part 4	Task Design
Part 5	Resource Development
Part 6	Wrap Up

Learning Challenges faced by Novice Programmers

“Education is not the filling of a pail but the lighting of a fire”

W. B. Yeats

Learning Challenges faced by Novice Programmers

What is the subtle difference between these two questions?

What aspects of programming do you think students find most challenging?

What aspects of programming do students find most challenging?

Learning Challenges faced by Novice Programmers

How did you learn how to program?

What were main challenges for you?

Learning Challenges faced by Novice Programmers

- What was the first programming language you learned?
- If you ever learned a second programming language how did the learning experience differ the second time around?
- Did you ever have that Aaahhh!! moment?
- Were there any programming constructs you found particularly difficult/easy to grasp?
- What was the balance between theory and practical?
- What were the practicals like?
- What approach was taken by your teachers?
- What was the nature of your learning?
- (In what ways might Computer Science differ from other subjects in terms of learning)

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Student Challenges – low level issues

- Variables
- Assignments
- Arrays
- Basic Programming Constructs e.g. loops, conditions
- Pointers and References
- Recursion

Student Challenges – high level issues

- Understanding program development environment
- Program Design
- Dividing functionality into procedures
- Debugging
- Higher-Level Programming Constructs (libraries , files i/o etc.)
- Students can understand syntax but find it difficult to construct programs
- Application
- Perceptions
- Differences with other subjects

The Teacher's Perspective

"The quality of an education system cannot exceed the quality of its teachers"

How the world's best-performing school systems come out on top (McKinsey Report 2007)

High School Scenario

Read and Discuss …..

High School Scenario

Read and Discuss …..

What teaching strategies could be used to address the issues highlighted?

Successful Strategies used by Teachers

- Metacognition
- Collaborative working
- Computational thinking
- Learning away from the computer (unplugged-style)
- Contextualisation
- Code tracing and scaffolding

Designing tasks to elicit metacognitive skills

"We only think when we are confronted with a problem"

John Dewey

Guiding Principles (1 of 2)

1. Design tasks with aims, but allow students to be rewarded for experimentation and exploration.

2. Design tasks that require students to record and monitor their activities

3. Avoid giving students programming exercises for which solutions can be directly copied from the notes

4. Avoid tasks that give step-by-step instructions on how to complete a task;

5. Design tasks that provide students with an opportunity to develop a plan and experiment

Guiding Principles (2 of 2)

6. Build into programming tasks opportunities for students to openly discuss plans of attack

7. Design tasks that require the logging of errors encountered, possible explanations and suggestions for fixes

8. Allow students to report on unpredictable problems that have been encountered

9. Design tasks that reward students for discovering interesting "technical" insights

10. Design tasks that require students to reflect, discuss and analyse their own learning

Designing tasks to elicit metacognitive skills

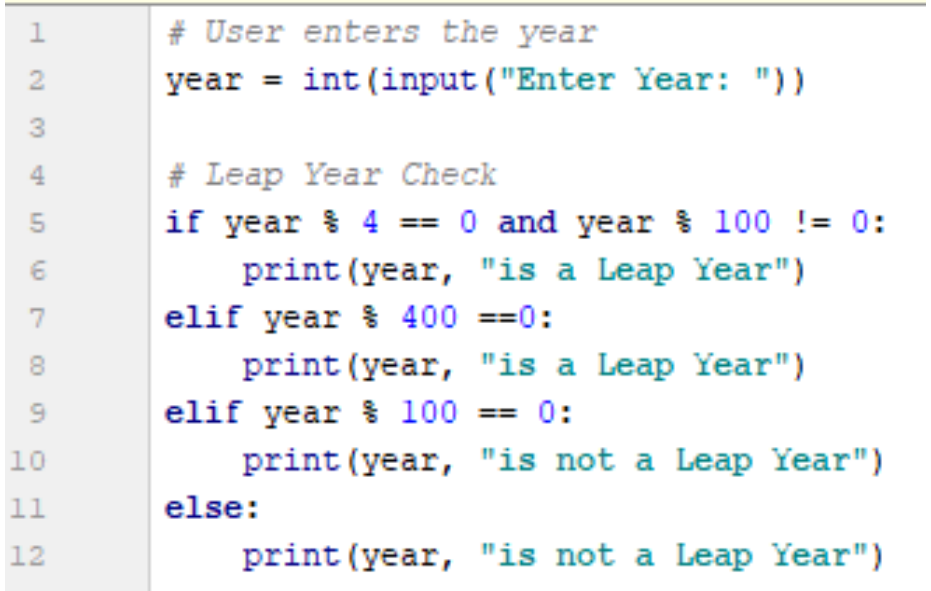
Assess the following tasks them in terms of their potential to elicit metacognitive skills …

Even numbered tables work on even numbered tasks and use even numbered guidelines

Odd numbered tables work on odd numbered tasks and use odd numbered guidelines

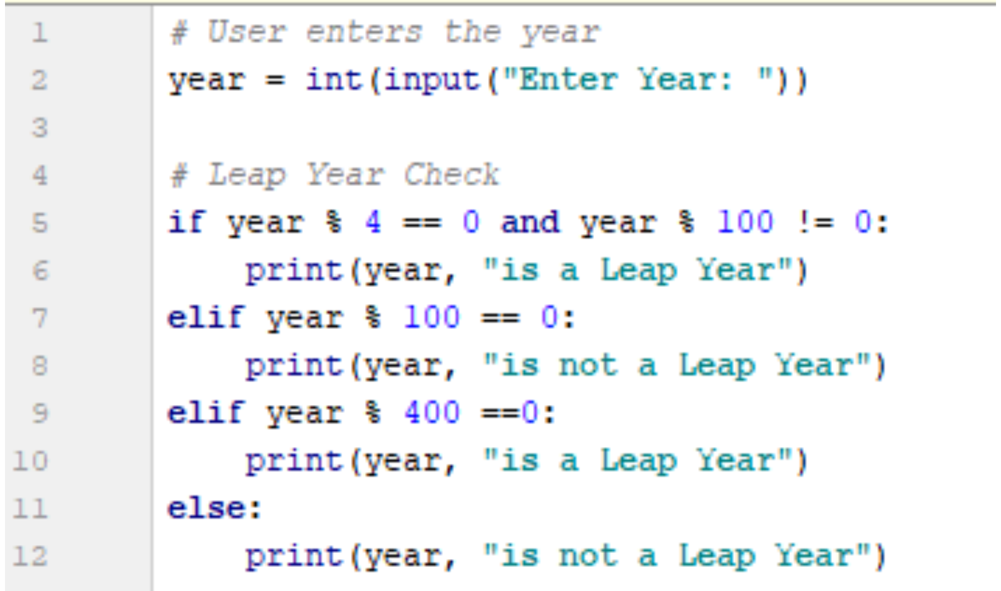
Task 1

Key in the two programs below and use them to verify that 1900 was *not* a leap year but 2000 was. One of the programs is incorrect? Which one? Can you fix the error?



```python
# User enters the year
year = int(input("Enter Year: "))

# Leap Year Check
if year % 4 == 0 and year % 100 != 0:
    print(year, "is a Leap Year")
elif year % 400 ==0:
    print(year, "is a Leap Year")
elif year % 100 == 0:
    print(year, "is not a Leap Year")
else:
    print(year, "is not a Leap Year")
```



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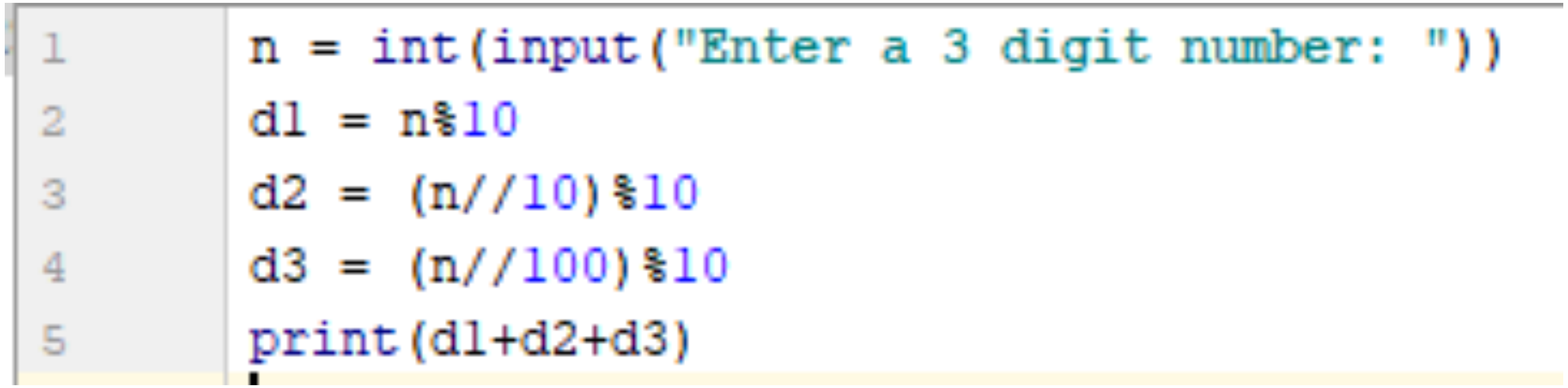
elif year % 400 ==0:
    print(year, "is a Leap Year")
else:
    print(year, "is not a Leap Year")
```

Task 2

Annotate and explain the following five-line program



```python
n = int(input("Enter a 3 digit number: "))
d1 = n%10
d2 = (n//10)%10
d3 = (n//100)%10
print(d1+d2+d3)
```

Task 3

Find the sum of all multiples of 3 and 5 that are less than 100?

A multiple is the result of multiplying one integer by another.

Task 4 – Match the Drawings to the Instructions (1 of 2)

Five commands are defined as follows:

`forward`	draws a line of length 1
`left`	turn 90° clockwise
`right`	turn 90° anti-clockwise
`red`	set pen colour to red
`black`	set pen colour to black

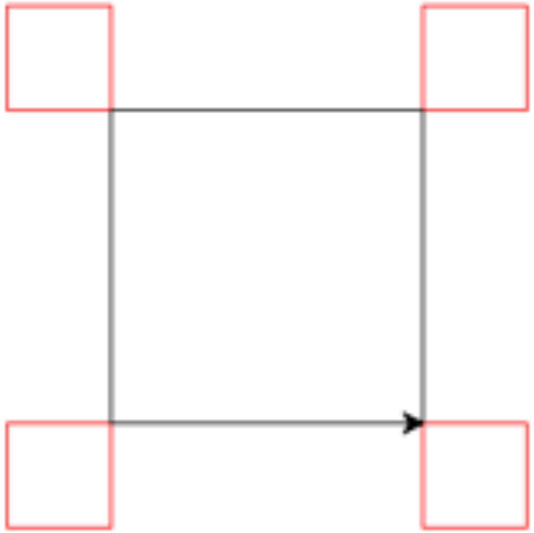
If X and Y are two commands then:

X, Y means do X and then do Y

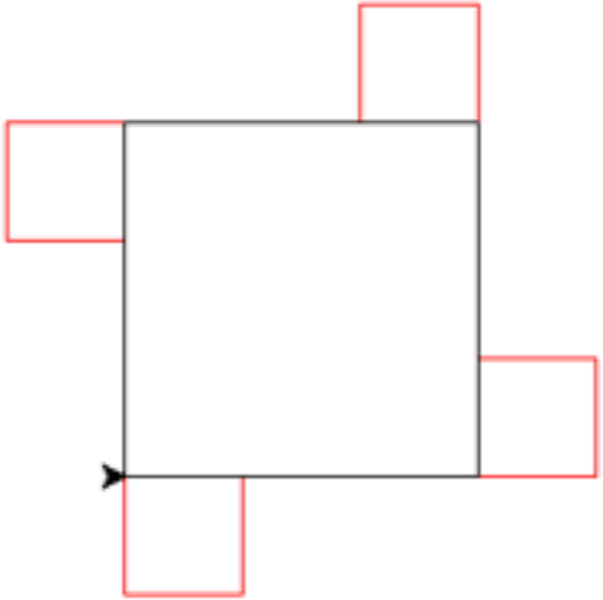
$n \times (X)$ means do X n times

Adapted from UK Bebras Computational Thinking Challenge 2014

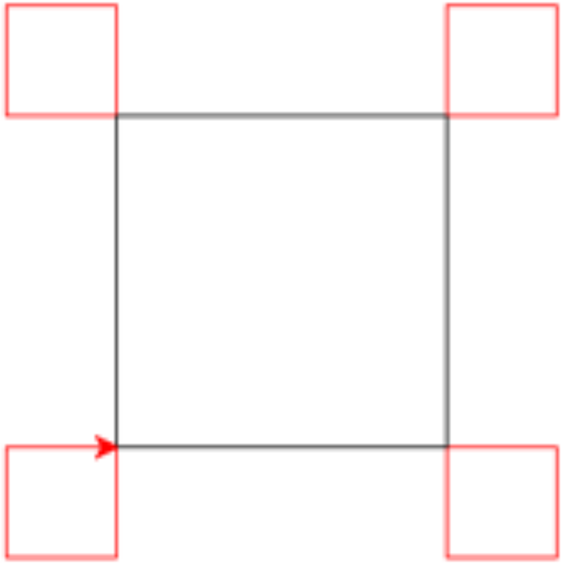
Task 4 – Match the Drawings to the Instructions (2 of 2)



Drawing 1



Drawing 2



Drawing 3

A. $4\times\ (3\times(black, forward), 4\times(red, forward, right), left))$

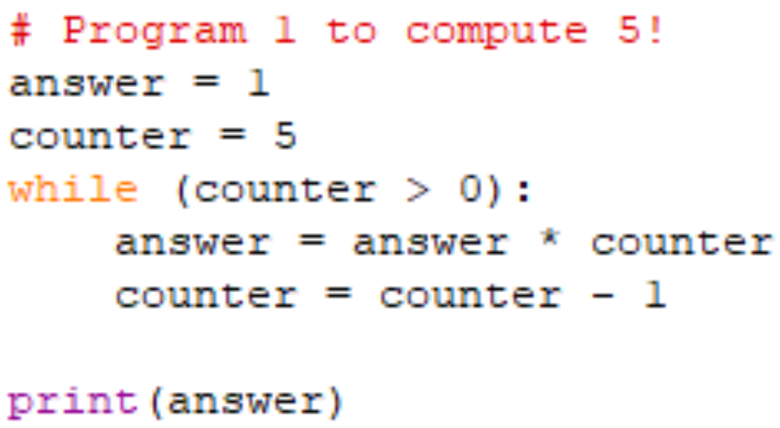
B. $4\times\ (4\times(red, forward, right), 3\times(black, forward), left))$

C. $4\times\ (4\times(red, forward, right), left, 3\times(black, forward))$

Adapted from UK Bebras Computational Thinking Challenge 2014

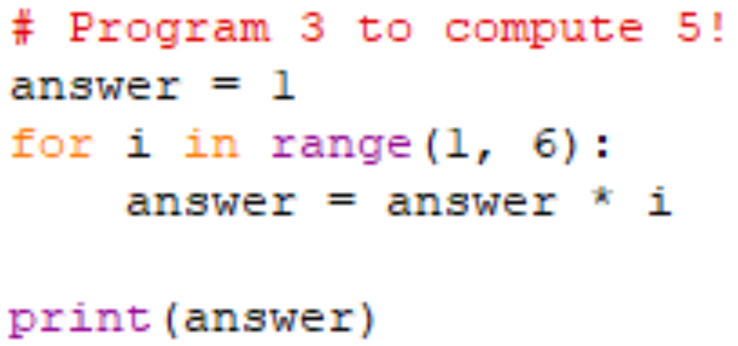
Task 5

Which of the following three programs do you prefer and why?



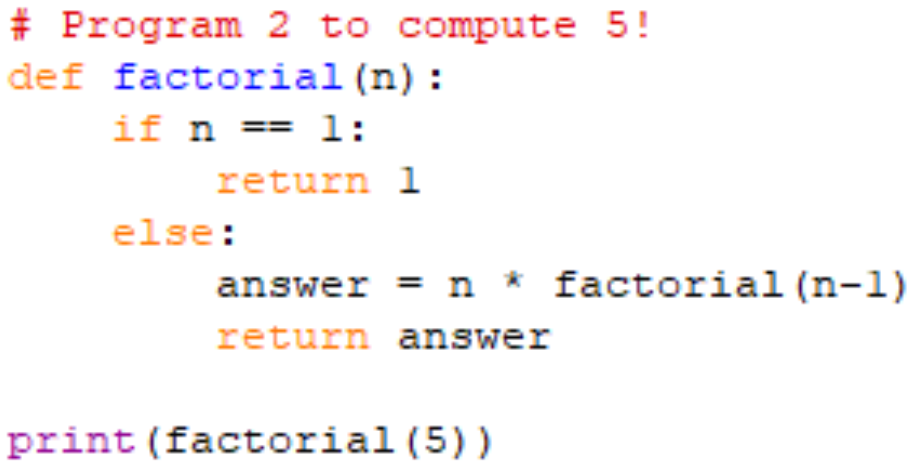
```
# Program 1 to compute 5!
answer = 1
counter = 5
while (counter > 0):
    answer = answer * counter
    counter = counter - 1

print(answer)
```



```
# Program 3 to compute 5!
answer = 1
for i in range(1, 6):
    answer = answer * i

print(answer)
```



```
# Program 2 to compute 5!
def factorial(n):
    if n == 1:
        return 1
    else:
        answer = n * factorial(n-1)
        return answer

print(factorial(5))
```

Task 6

Given a list of cities and the distances between each pair of cities, what is the shortest possible route that visits each city and returns to the city of origin?

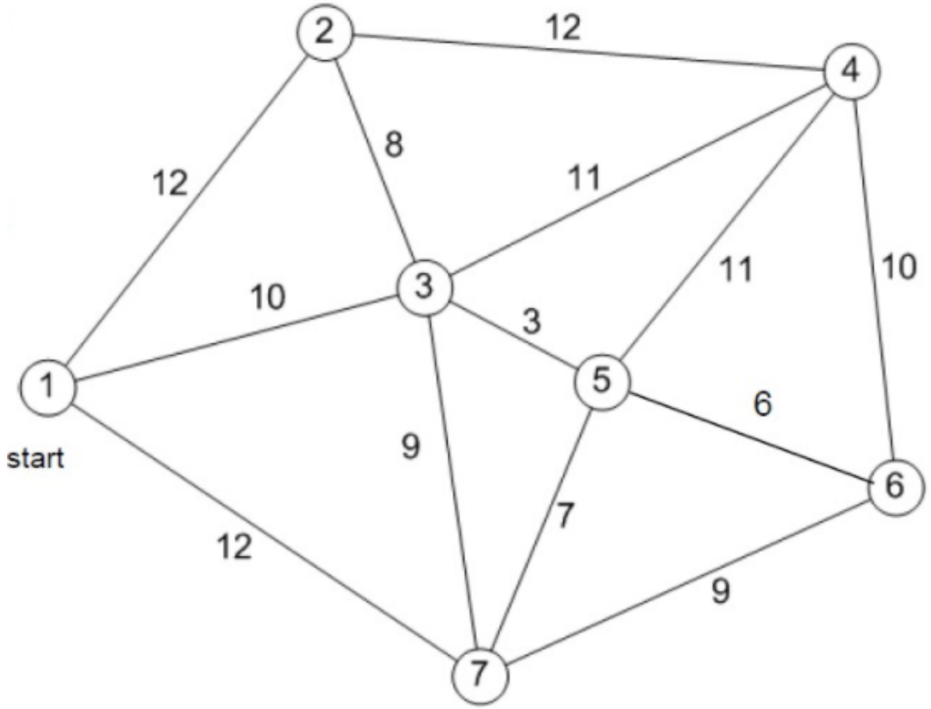
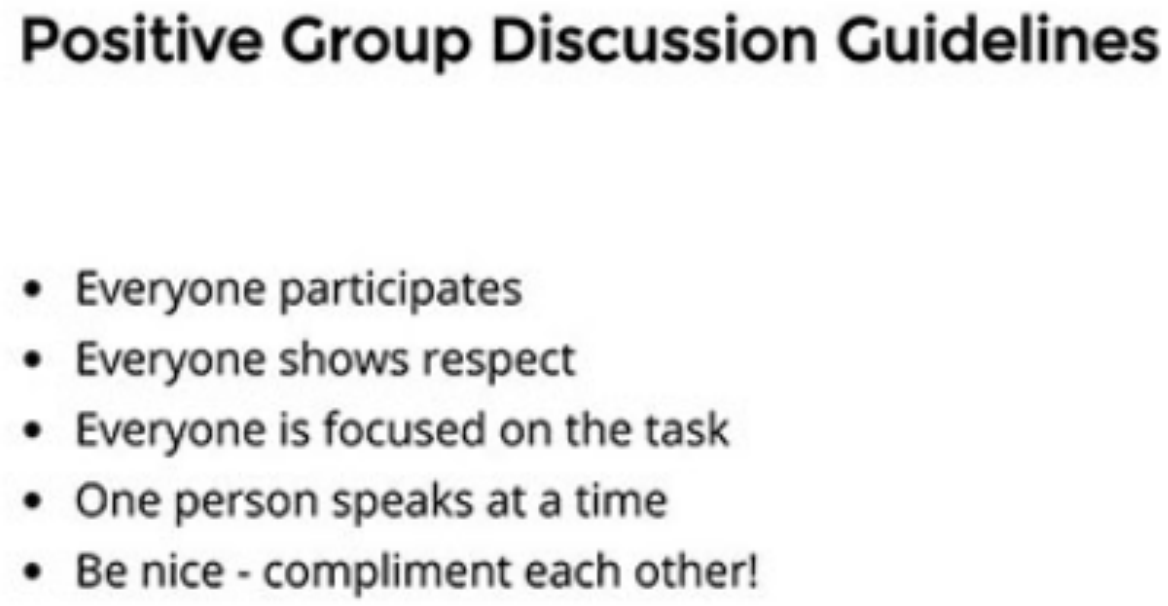


Table Discussion



Positive Group Discussion Guidelines

- Everyone participates
- Everyone shows respect
- Everyone is focused on the task
- One person speaks at a time
- Be nice - compliment each other!

Table Discussion

In what ways do the tasks meet/fail to meet the guidelines?

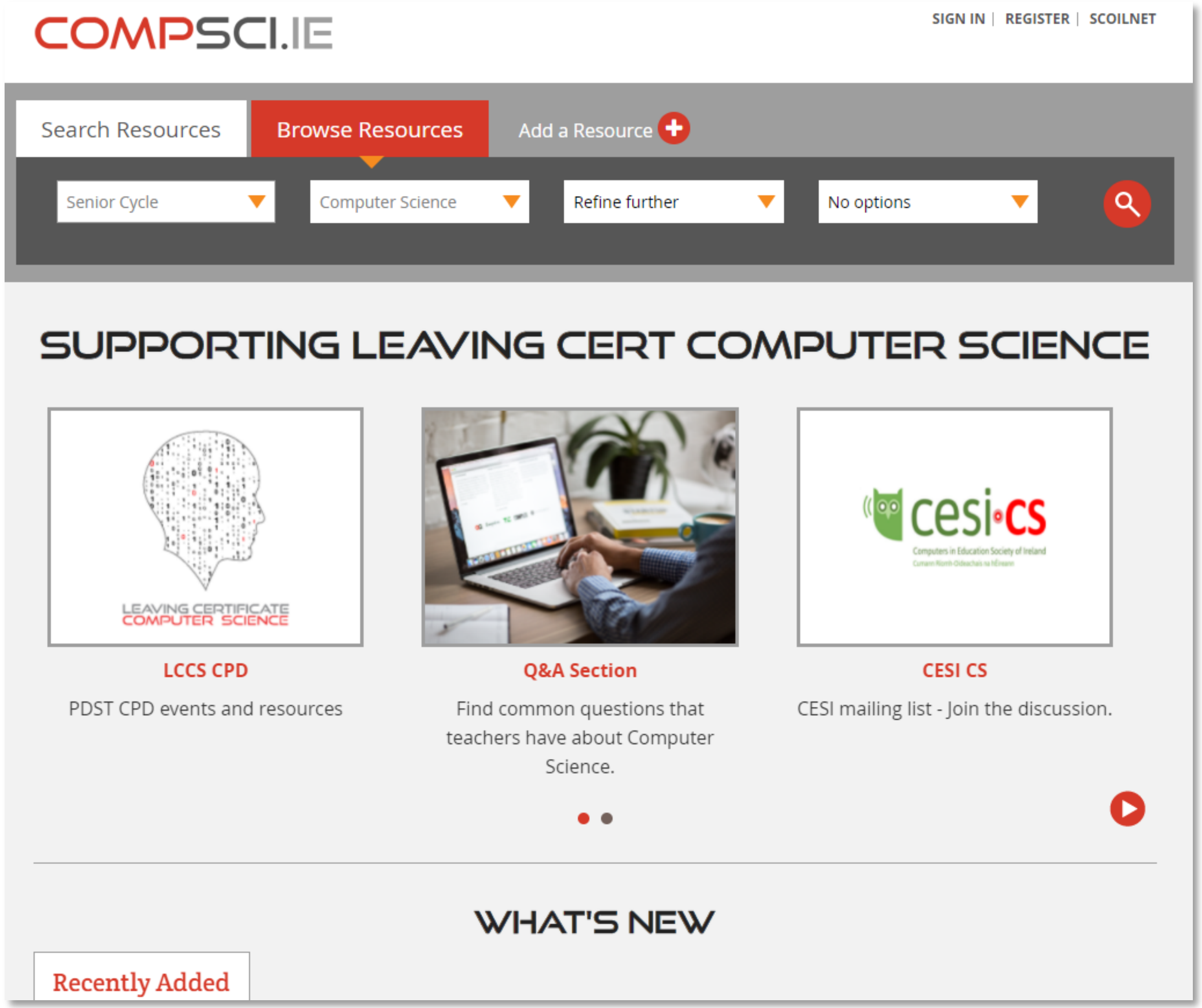
General Discussion Prompts

- In what ways do the tasks meet/fail to meet the guidelines?
- Would you change the task in any way?
- What prior knowledge would be required for students to be able to complete this task?
- Do you think is would be reasonable to expect students to attempt a problem without having being taught this prior knowledge in class?

Resource Development

“By failing to prepare, you are preparing to fail”

Benjamin Franklin



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SUPPORTING LEAVING CERT COMPUTER SCIENCE

LEAVING CERTIFICATE COMPUTER SCIENCE
cesi·cs
Computers in Education Society of Ireland

LCCS CPD

PDST CPD events and resources

Q&A Section

Find common questions that teachers have about Computer Science.

CESI CS

CESI mailing list - Join the discussion.

WHAT'S NEW

Recently Added

COMPSCI.IE

What is Compsci.ie?

Who is it for?

Why is it needed?

How does it work?

Where is my role?

Activity to take home

1. Pick a topic from the bag going around the room.

2. Find and upload to Compsci.ie three resources for your topic before we meet again at the end of May

Wrap Up

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