Check Your Homework with Your Phone

John Wagner & Amanda Malefyt
Mcketta Department of
Chemical & Bioprocess Engineering
Trine University

Garth Thomas Jr.
West Virginia University Institute of Technology

Learning objectives of the presentation

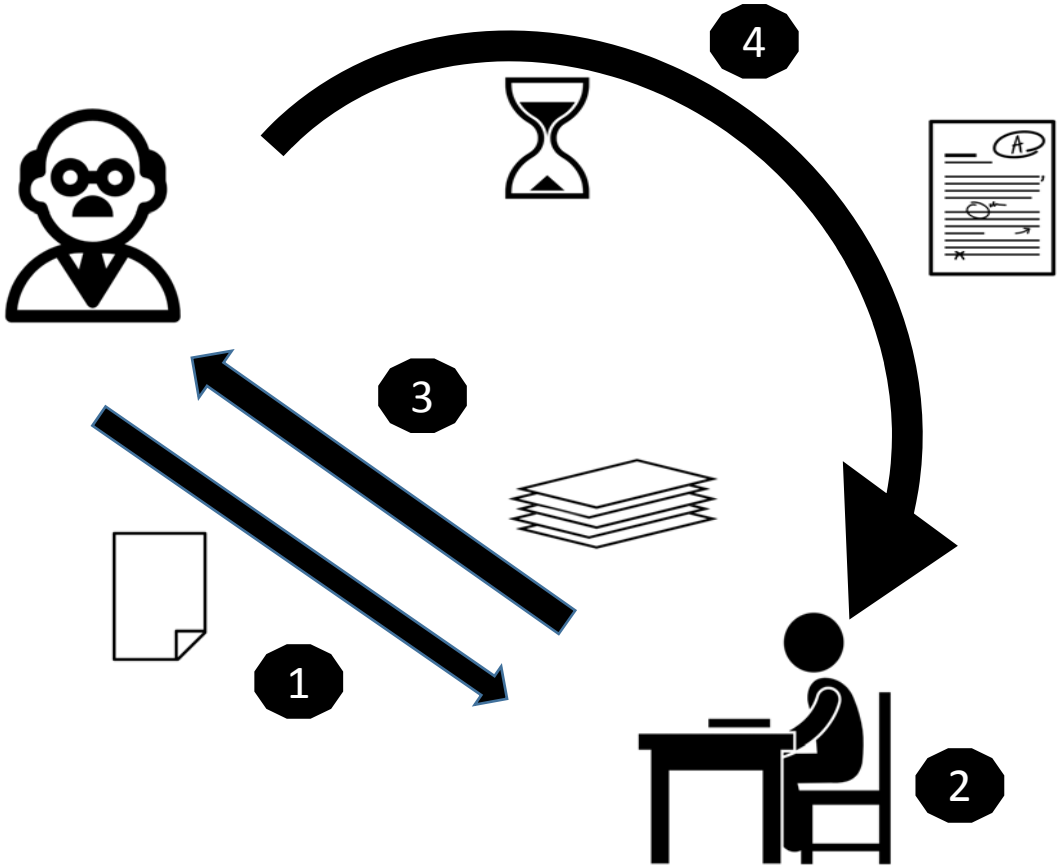
by the end of this presentation you should be able to describe what the:

1) QRProblems look like from the student's perspective

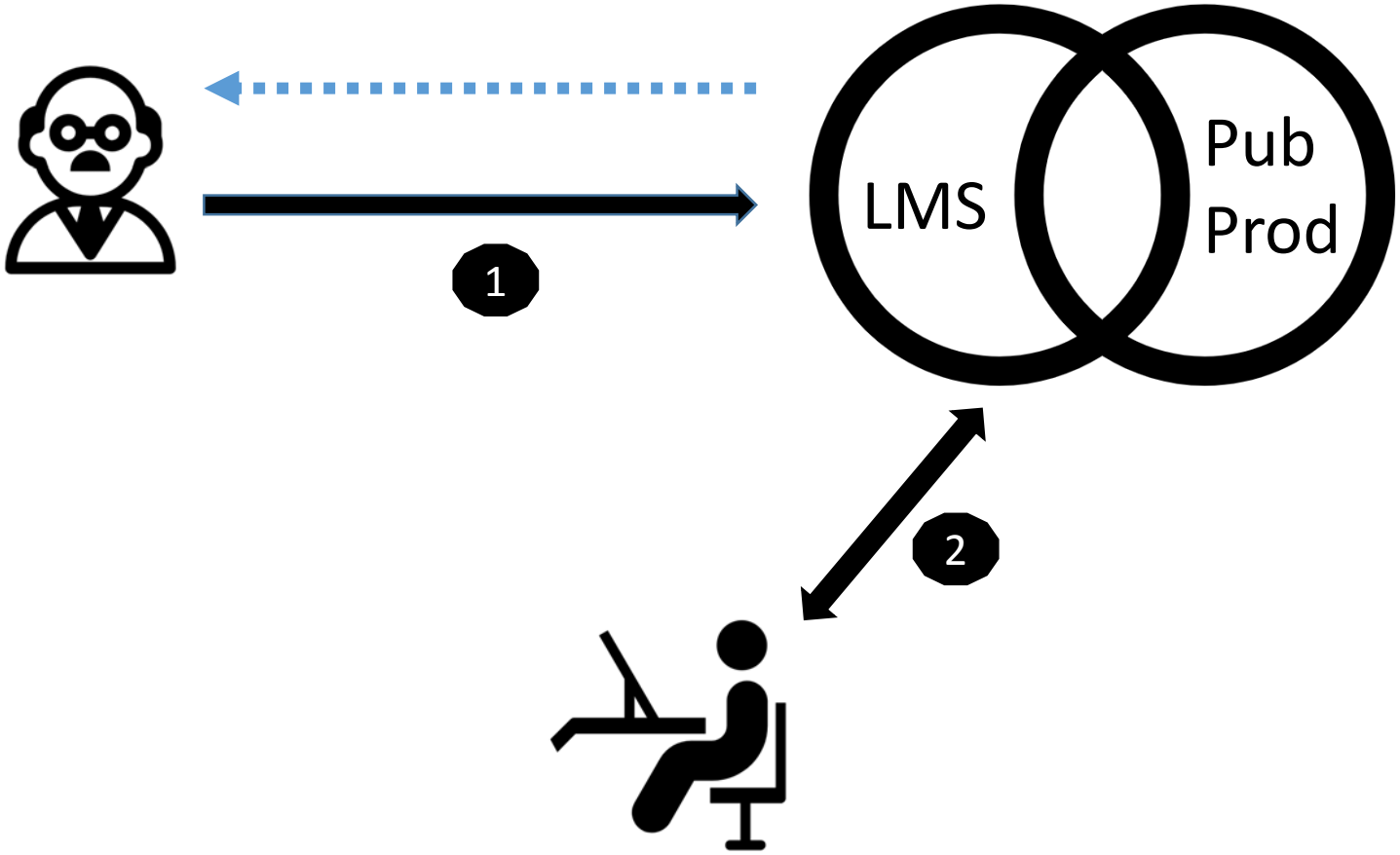
2) help that is available for students who get stuck

3) terms “base-case”, PIN and rtn Code mean

Traditional Engineering Homework



Online system

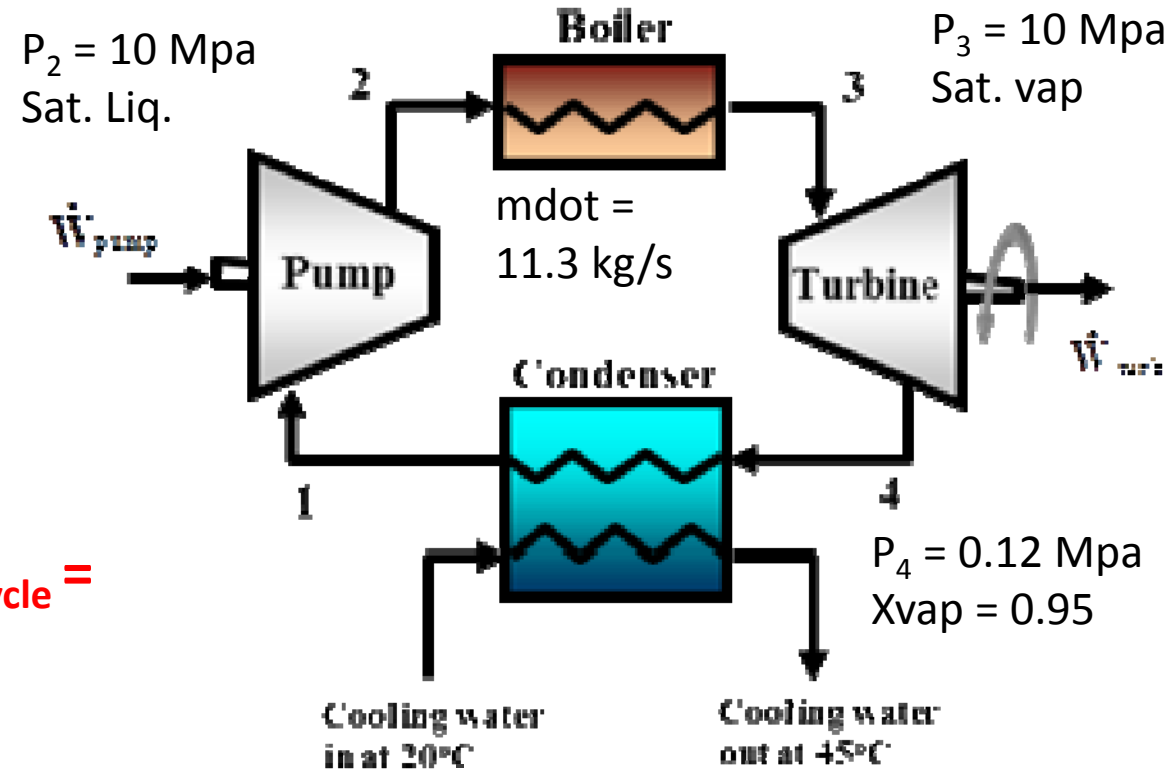


What would you do first?

A steam power plant, operates at steady-state. The boiler operates at a pressure of 10 MPa, while the condenser pressure is 0.12 MPa. The inlet to the boiler is a saturated liquid while the boiler outlet is a saturated vapor. The mass flow rate of the circulating steam is 11.3 kg/s. The quality of steam exiting the turbine is 0.95. State any assumptions and determine the:

- a) power output of the turbine in MW
- b) The thermal efficiency of the power cycle

Same problem or different?

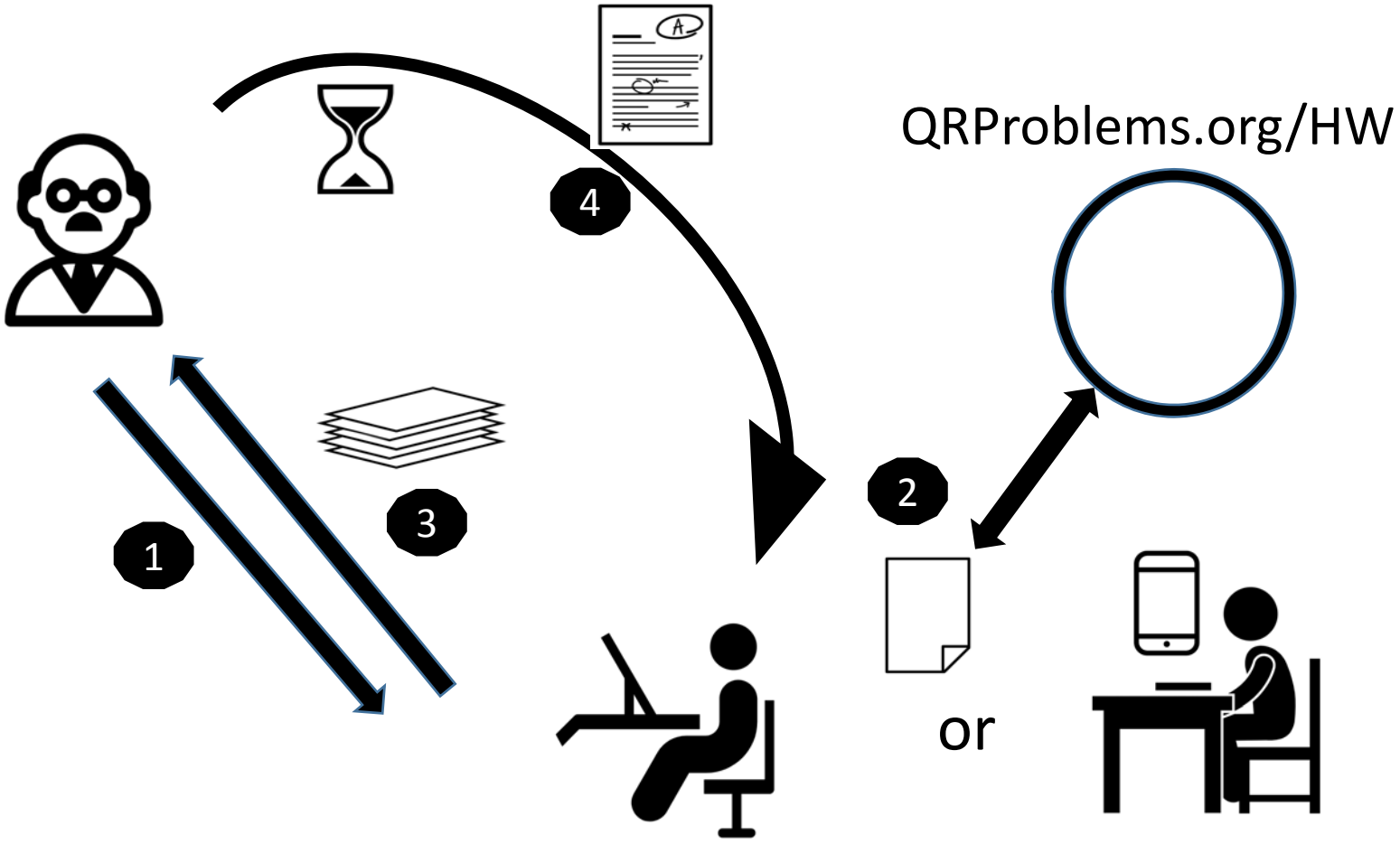


W_{turb} =

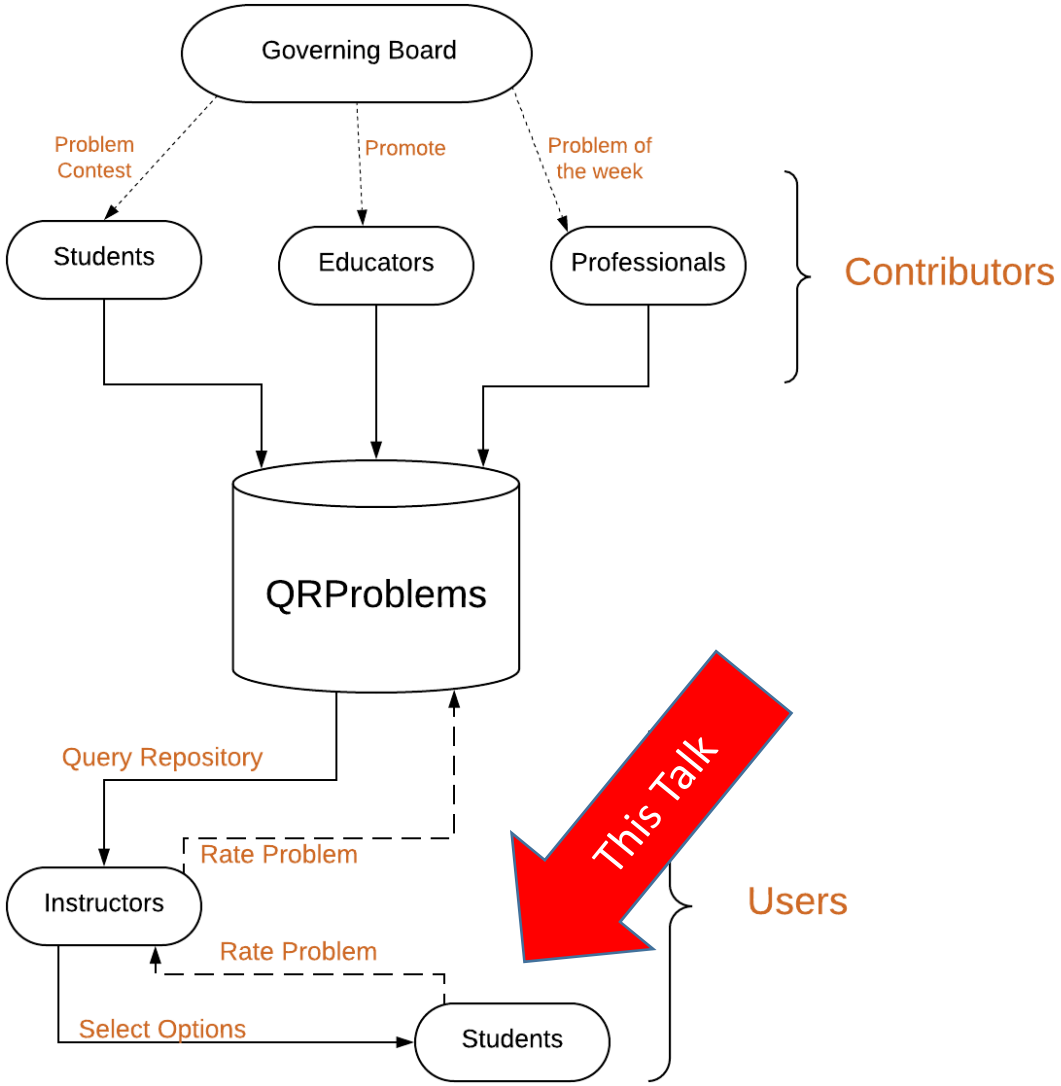
η_{cycle} =

Diagram from W.B. Baratuci LearnThermo.com

QRProblem System



Conceptual Structure of the Repository



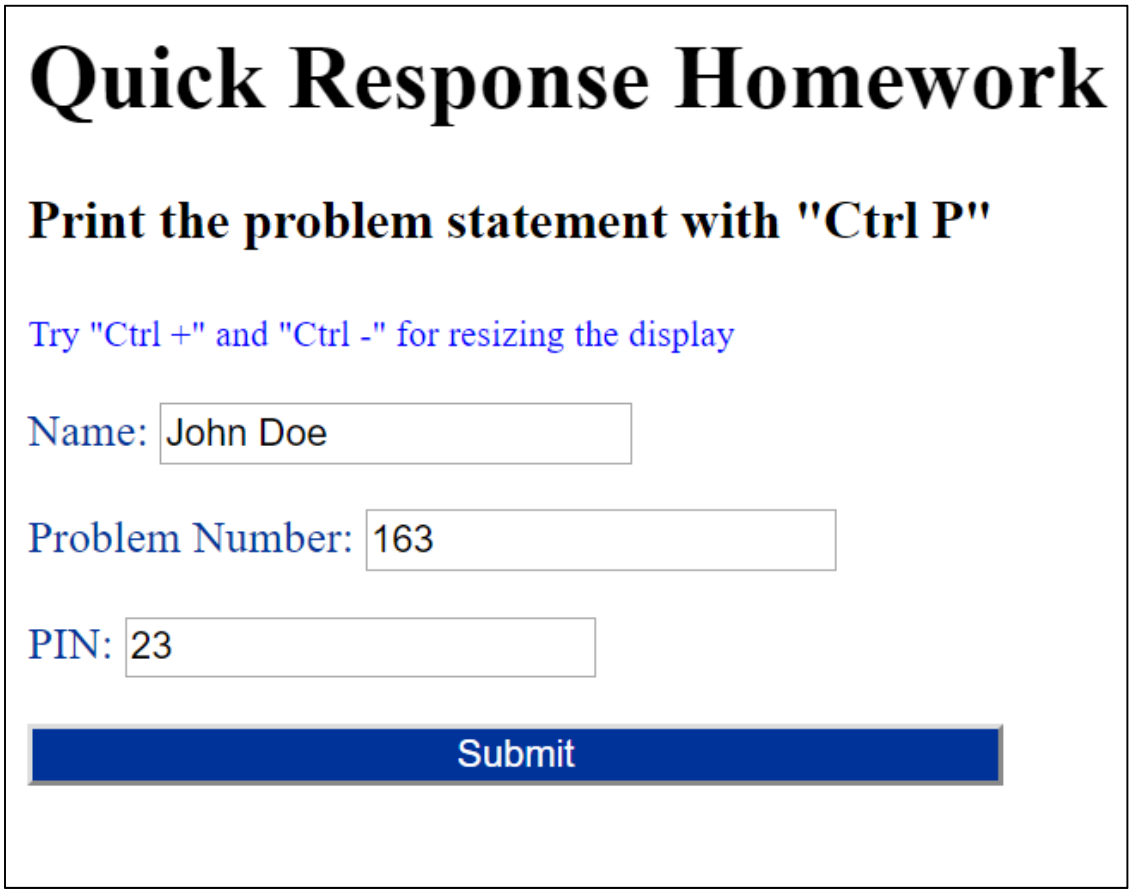
Goals of the Problem Repository System

- Fast & Easy
- Flexible
- Good Problems
- Some Support
- Connection / Reflection

From the Students View:

1) **QRP 163** from **QRProblems.org/hw** with the score and rtn code. Attach your work for the problem and pick <u>one</u> of the short answer problems

On Computer student goes to QRProblems.org/HW



Problem Print Out

Name: John Doe Problem: 163 PIN: 23

Score: _____ rtn Code _____-_____

There are three musts that hold us back: I must do well. You must treat me well. And the world must be easy. Albert Ellis

Please check your responses with https://qrproblems.org/prob or scan the QR code. You will need to put in your Problem Number and index number (given above) to check your responses. When you are finished checking, click the "get rtn Code" button at the bottom of the sheet - **Write the score and the rtn Code in the space provided above.** No credit for the computer graded part of problem if a clear rtn Code is not provided. Documenting your work is important – please return this sheet along with your work. If you run into problems, see if you can get the answers to the base-case problem and use the problem hints.

Steam is used to drive a turbine. The steam enters the turbine at a temperature of 528 °C and an absolute pressure of 1.4 MPa. The outlet stream is at a pressure of 0.019 MPa and has a quality (vapor fraction) of 98.9 %. Assuming the turbine operates adiabatically and using the NIST tables at https://webbook.nist.gov/chemistry/fluid , determine the:

a) specific work produced by the turbine kJ/kg
b) specific work for a reversible turbine operating between the two pressures kJ/kg
c) efficiency of the turbine in %
d) entropy generation of the turbine in kJ/(kg K)

Base Case Index = 1

Steam is used to drive a turbine. The steam enters the turbine at a temperature of 500 °C and an absolute pressure of 1.4 MPa. The outlet stream is at a pressure of 0.01 MPa and has a quality (vapor fraction) of 99 %. Assuming the turbine operates adiabatically and using the NIST tables at https://webbook.nist.gov/chemistry/fluid , determine the:

a) specific work produced by the turbine kJ/kg
b) specific work for a reversible turbine operating between the two pressures kJ/kg
c) efficiency of the turbine in %
d) entropy generation of the turbine in kJ/(kg K)

The following short answer / reflection questions are available with this problem

i) Reflect – Expert problem solvers reflect on the process. Describe in words your problem-solving methodology and your ability to solve this problem. Some questions you may want to consider include:

- Did you get the answer to all parts on the first try? If not, what was your most serious mistake and how could you minimize that type of mistake in the future.
- What part of your solution strategy went well? What part could use improvement?
- Were you stuck on one part? What process was effective in getting unstuck?
- Did you use a well-defined problem-solving algorithm? If not, why not?
- Did you start early enough to give yourself time to step away from the problem and "incubate the problem"?
- If you could give advice to your former self regarding this problem, or homework set, what would it be?

ii) Explore – Write a concluding statement for this problem. What are two changes that could increase the efficiency and what are the practical limitation of those changes?

iii) Connect – If you wanted to run this turbine and produce the same work as a typical car, what flow rate of steam would you need? Cite any references?

iv) Safety & Society – Look up Steam turbine on Wikipedia. About how much of the electricity is generated by steam turbines? Pick out three interesting facts about steam turbines from the article and summarize them.

Score and rtn Code

Boiler plate – Address for checker

Problem

Base-case – Common

Reflection

Try one?

Use your Phone and go to:

QRProblems.org/prob

or Scan the QRCode

Should have something that looks like this

Name: IMA Student Problem: 175 PIN: 2

Score: _____ rtn Code _____-_____

When the world says, 'Give up,' Hope whispers, 'Try one more time.' Unknown

Please check your responses with https://qrproblems.org/prob or scan the QR code. You will need to put in your Problem Number and index number (given above) to check your responses. When you are finished checking, click the "get rtn Code" button at the bottom of the sheet - **Write the score and the rtn Code in the space provided above**. No credit for the computer graded part of problem if a clear rtn Code is not provided. Documenting your work is important – please return this sheet along with your work. If you run into problems, see if you can get the answers to the base-case problem and use the problem hints.

You are ordering floor covering for a room. The room is rectangularly shaped with one side having a length of 9 ft while the other side is 5 ft. Determine the:

a) area of the room in ft^2
b) length from one corner of the room to the opposite corner in ft

Base Case Index = 1

You are ordering floor covering for a room. The room is rectangularly shaped with one side having a length of 10 ft while the other side is 5 ft. Determine the:

a) area of the room in ft^2
b) length from one corner of the room to the opposite corner in ft

Quick Response Problems

Missing problem number

Problem Number:

PIN:

Submit

QRProblem Checker

Problem Number: 175

PIN: 2

Fill in - then select "Check"

a): 0 ft^2 -

b): 0 ft -

Check **Score: 0%**

Count: 1

When Finished:

Get rtn Code

Get Base-Case Answers

Check Answers

QRProblem Checker

Problem Number: 175

PIN: 2

Fill in - then select "Check"

a): 45 ft^2 **- Correct**

b): 12 ft **- Not Correct**

Check **Score: 50%**

Count: 3

When Finished:

Get rtn Code

Get Base-Case Answers

Get Answers to the Base-Case

QRProblem Checker

Problem Number: 175

PIN: 2

Fill in - then select "Check"

a): 0 ft^2 -

b): 0 ft -

Check **Score: 0%**

Count: 4

When Finished:

Get rtn Code

Get Base-Case Answers

Base-Case Answers:

a	b
50	11.18

Get part b wrong a few times

QRProblem Checker

Problem Number: 175

PIN: 2

Fill in - then select "Check"

a): 45 ft^2 **- Correct**

b): 12 ft **- Not Correct** hints for this part

Check **Score: 50%**

Count: 8

When Finished:

Get rtn Code

Get Base-Case Answers

Should Get your hints in terms of a multiple-choice question

Quick Response Hints

- **What does it mean to square a number?**

  - add it to itself
  - multiply it times itself
  - divide it by itself
  - Multiply it by two

- **What is 5^2?**

  - 25
  - 10
  - 2.5
  - 125

- **What is the Pythagorean theorem?**

  - $h^2 = a + b$
  - $h^2 = a^2 + b^2$
  - $h = a + b$
  - $h^{0.5} = a^{0.5} + b^{0.5}$

- **What is the hypotenuse of a triangle?**

Press “get rtn-Code

QRProblem Checker

Problem Number: 175

PIN: 2

Fill in - then select "Check"

a): 45 ft^2 **- Correct**

b): 10.3 ft **- Correct**

Check **Score: 100%**

Count: 3

When Finished:

Get rtn Code

Get Base-Case Answers

Copy the Score and Code to printout

Your Computer Score: 100%

Your rtn Code: 949971-1975

Return to Main Screen

Each PIN has different Problem Parameters

Steam is used to drive a turbine. The steam enters the turbine at a temperature of 528 °C and an absolute pressure of 1.4 MPa. The outlet stream is at a pressure of 0.019 MPa and has a quality (vapor fraction) of 98.9 %. Assuming the turbine operates adiabatically and using the NIST tables at https://webbook.nist.gov/chemistry/fluid , determine the:

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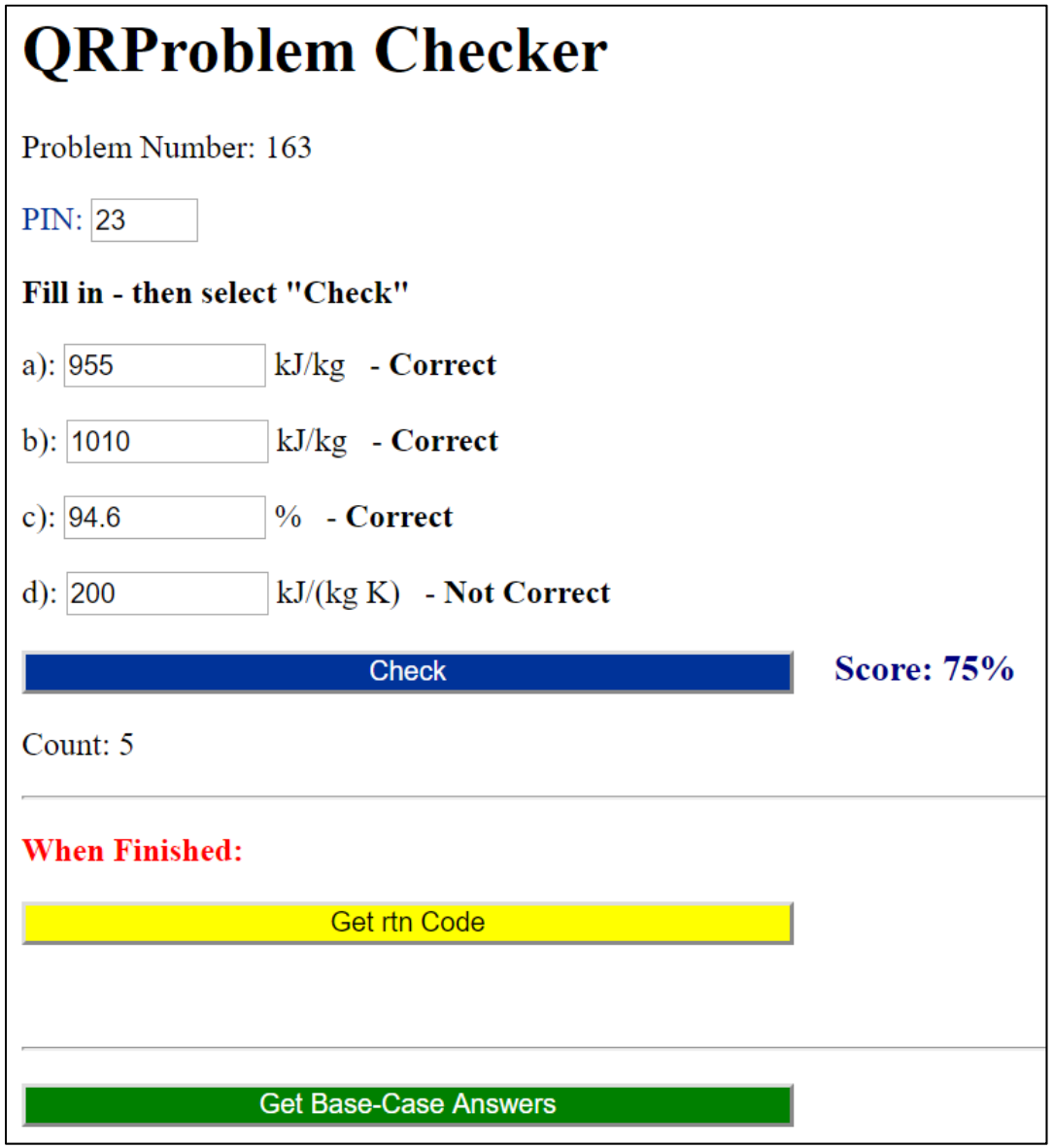
QRProblem Checker

Phone Friendly



QRProblem Checker

Problem Number: 163

PIN: 23

Fill in - then select "Check"

a): 955 kJ/kg **- Correct**

b): 1010 kJ/kg **- Correct**

c): 94.6 % **- Correct**

d): 200 kJ/(kg K) **- Not Correct**

Check **Score: 75%**

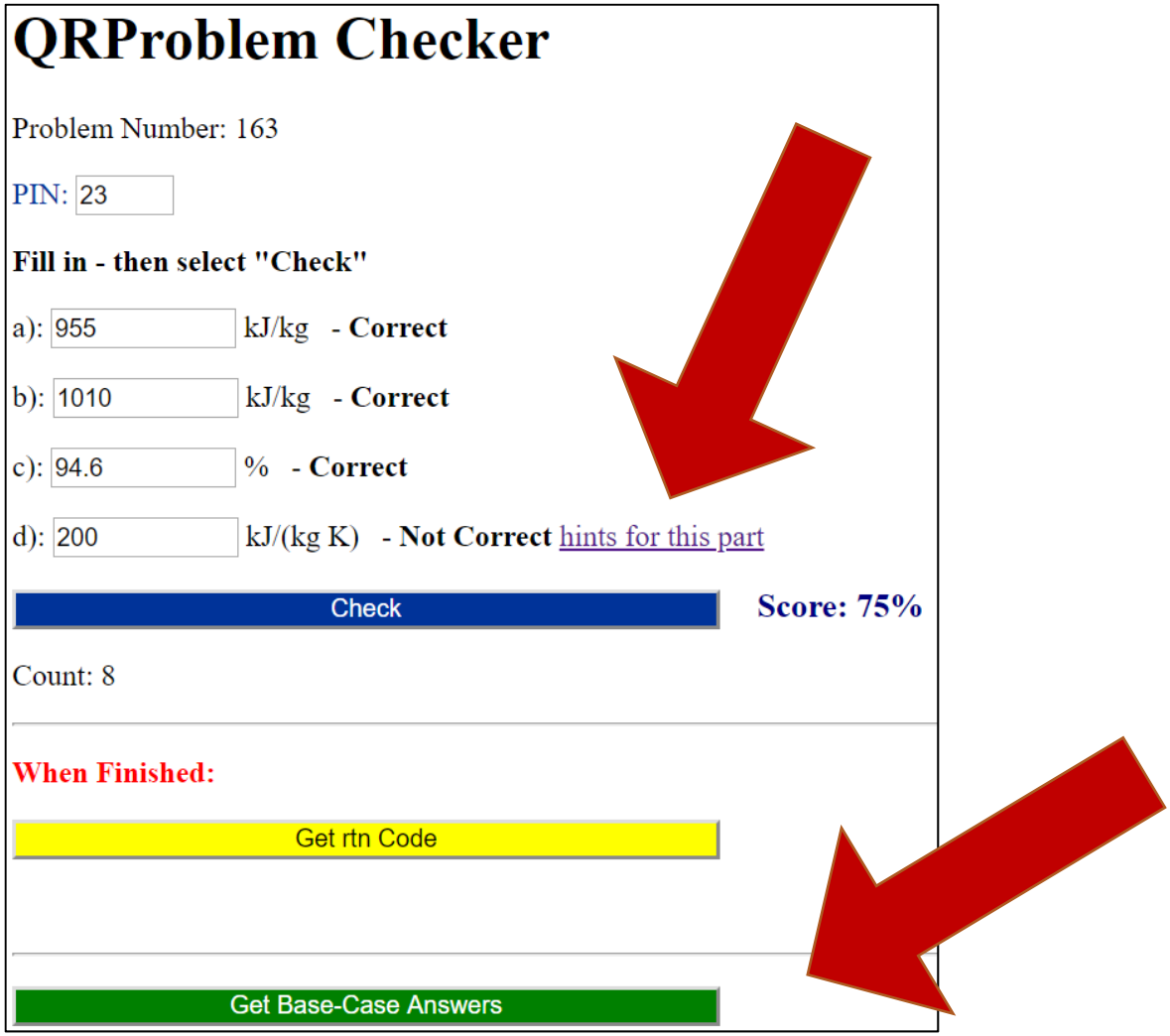
Count: 5

When Finished:

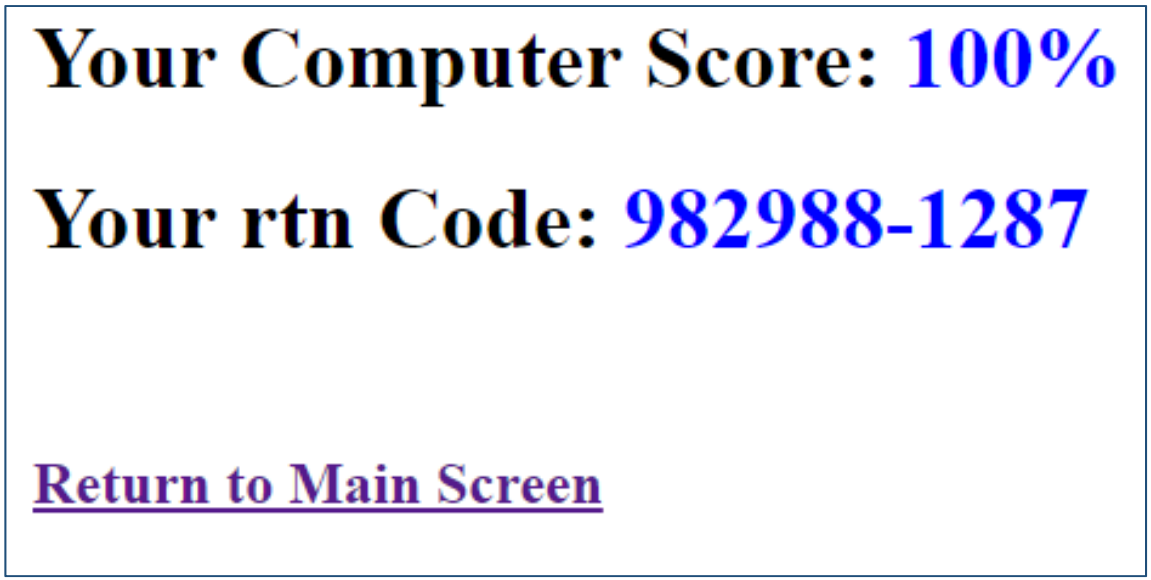
Get rtn Code

Get Base-Case Answers

Support for Stuck Students



“Get rtn Code” would give:



The above would be copied onto problem printout

Reflection / Short Answer

The following short answer / reflection questions are available with this problem

i) Reflect – Expert problem solvers reflect on the process. Describe in words your problem-solving methodology and your ability to solve this problem. Some questions you may want to consider include:

- Did you get the answer to all parts on the first try? If not, what was your most serious mistake and how could you minimize that type of mistake in the future.
- What part of your solution strategy went well? What part could use improvement?
- Were you stuck on one part? What process was effective in getting unstuck?
- Did you use a well-defined problem-solving algorithm? If not, why not?
- Did you start early enough to give yourself time to step away from the problem and "incubate the problem"?
- If you could give advice to your former self regarding this problem, or homework set, what would it be?

Reflect - Metacognitive

ii) Explore – Write a concluding statement for this problem. What are two changes that could increase the efficiency and what are the practical limitation of those changes?

Explore Problem

iii) Connect – If you wanted to run this turbine and produce the same work as a typical car, what flow rate of steam would you need? Cite any references?

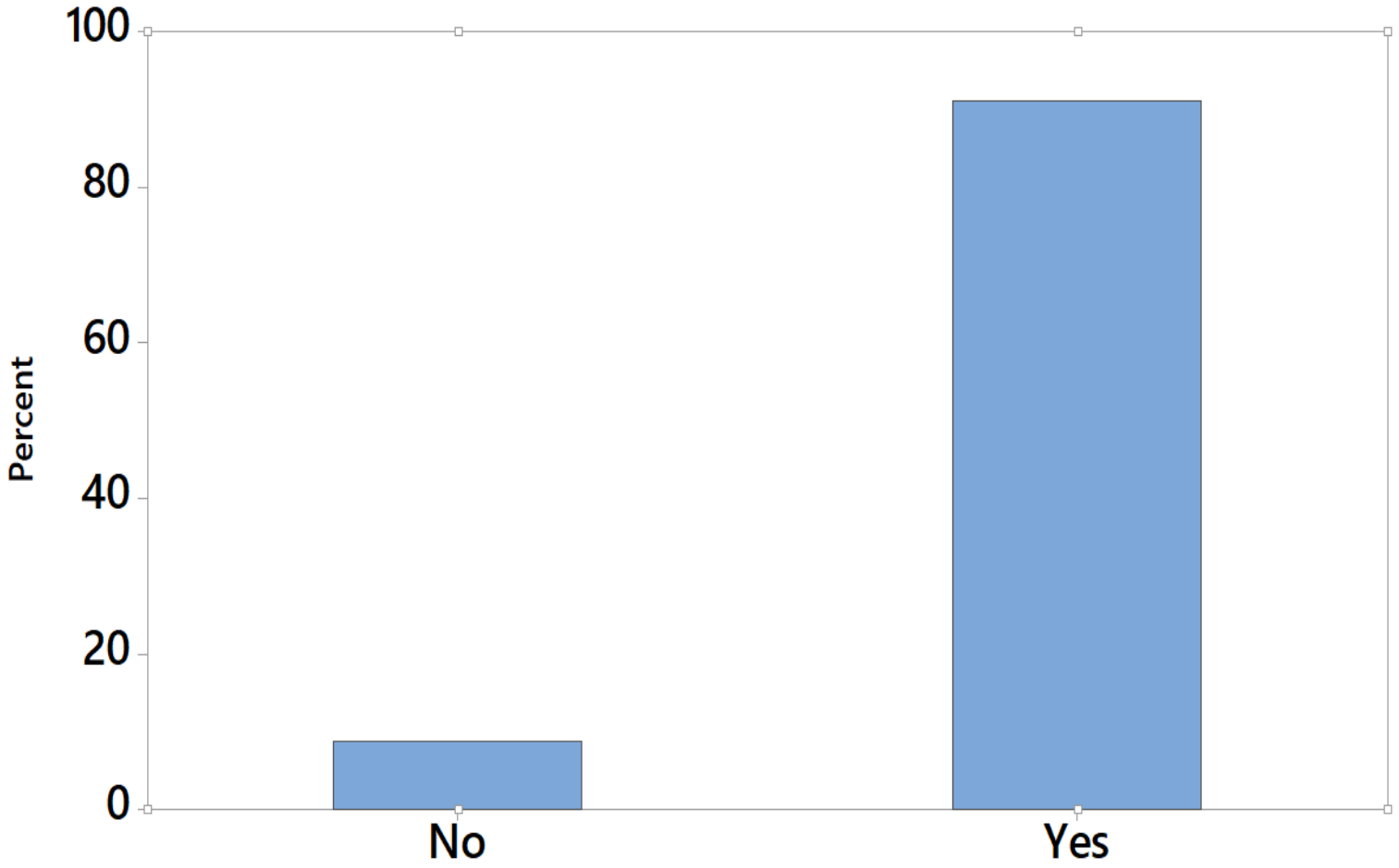
Connect

iv) Safety & Society – Look up Steam turbine on Wikipedia. About how much of the electricity is generated by steam turbines? Pick out three interesting facts about steam turbines from the article and summarize them.

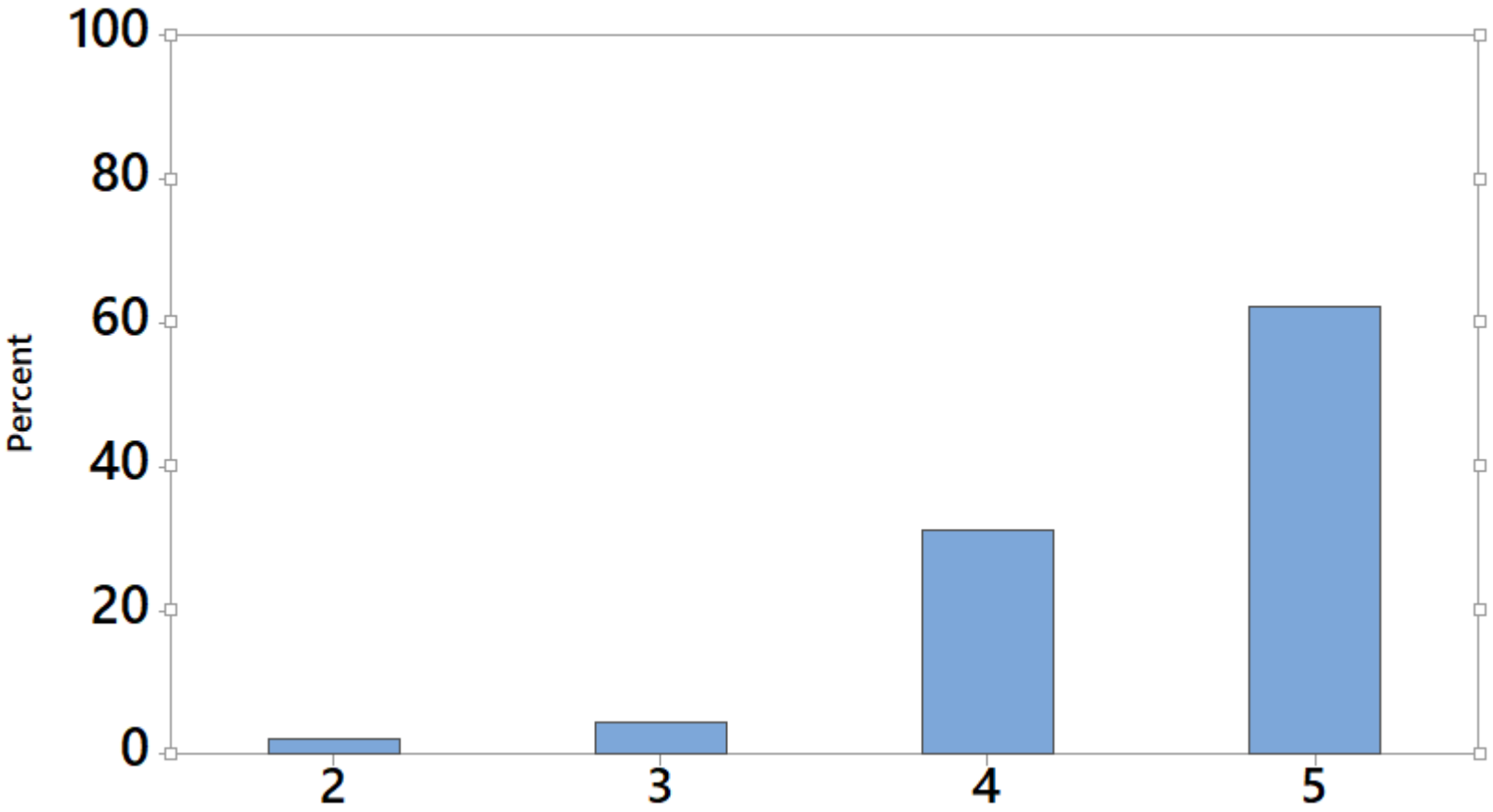
Safety / Society

Student Survey Results (n = 45):

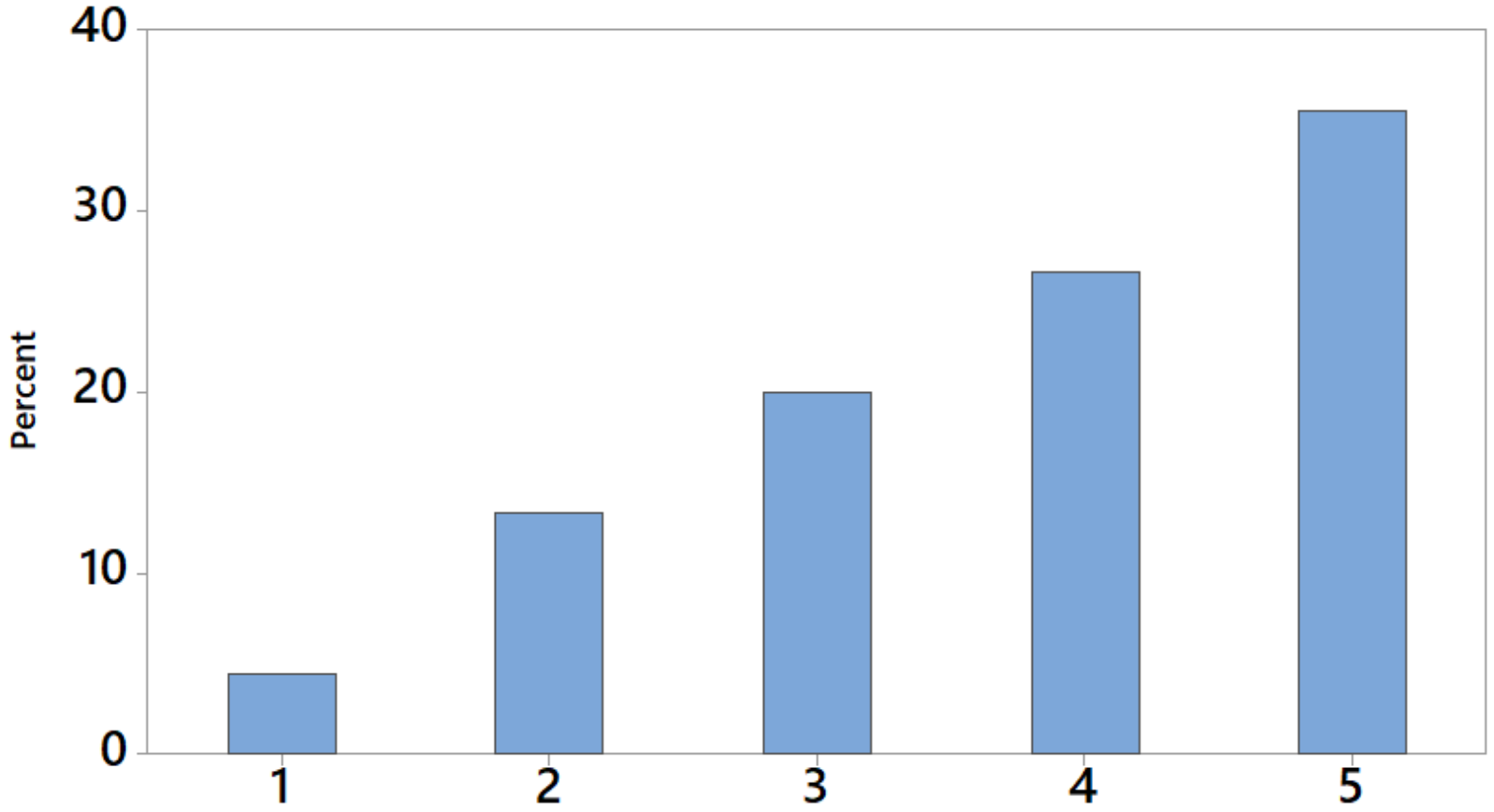
Would you like to see QRProblems used in your other classes that have a quantitative component?



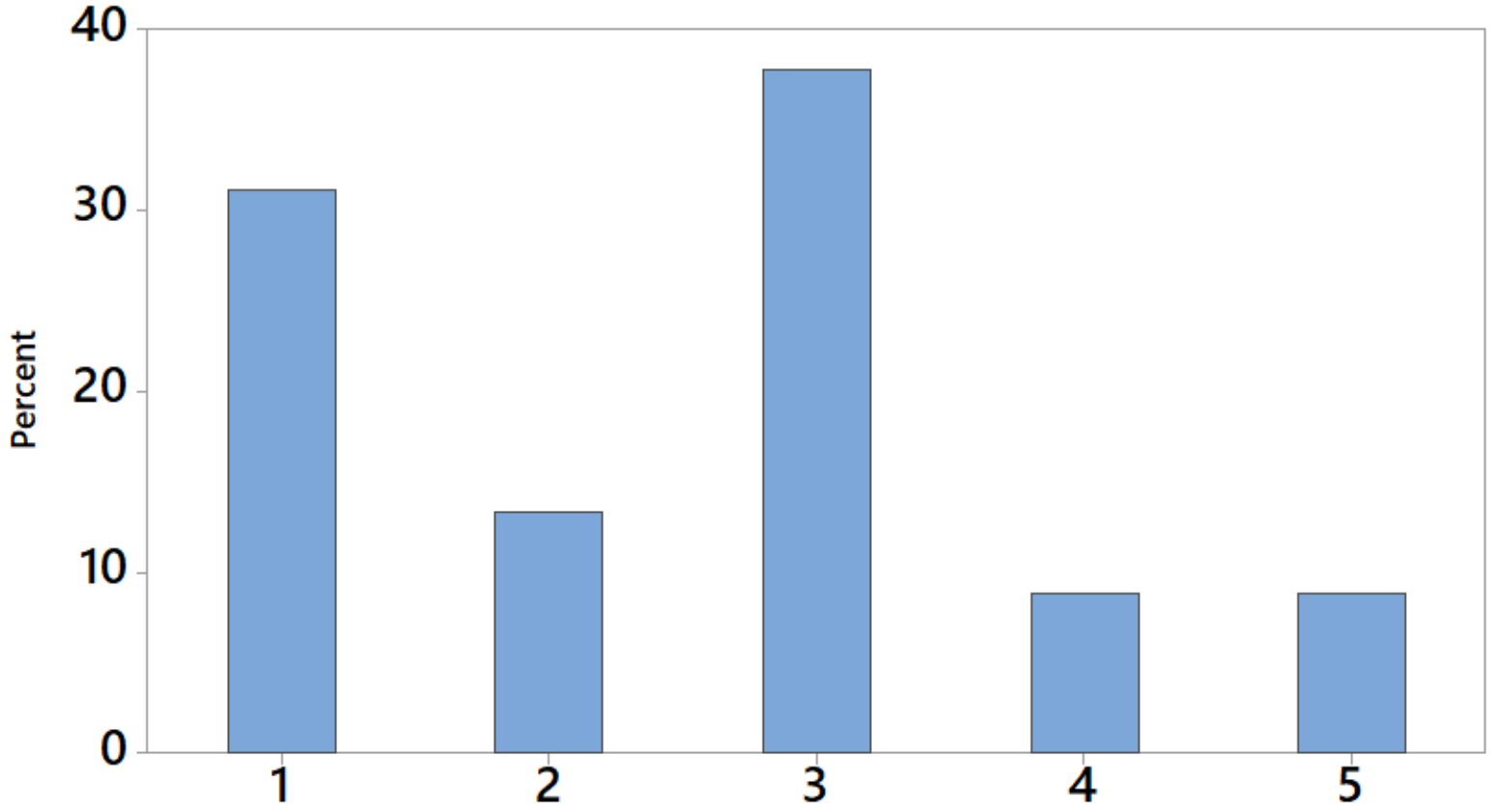
I believe that it is beneficial to my learning to get immediate feedback on my response correctness and be able to fix it. (1 = Strongly Disagree 5 = strongly agree)



I like the option of printing off the problem and using my phone to check my solution (1 = Strongly Disagree 5 = strongly agree)



The additional short answer questions improve my understanding of the concepts in the problem and / or provide some connection or needed context.



Summary

A problem repository has been started that will contain:

- Numerical based problems that students can print off and use their phone or computer to check the answers
- QRProblems are freely available and should work on any homework system

Future Work

1) More problem in more subjects
2) Instructional videos / tutorials for instructors
3) Better interface for the instructor to query repository
4) Feedback rating from students and instructors
5) More hints for problems
6) Better interface for developers
7) Develop better Reflection / Short Answer Questions

Learning objectives of the presentation

by the end of this presentation you should be able to describe what the:

1) QRProblems look like from the student's perspective

2) help that is available for students who get stuck

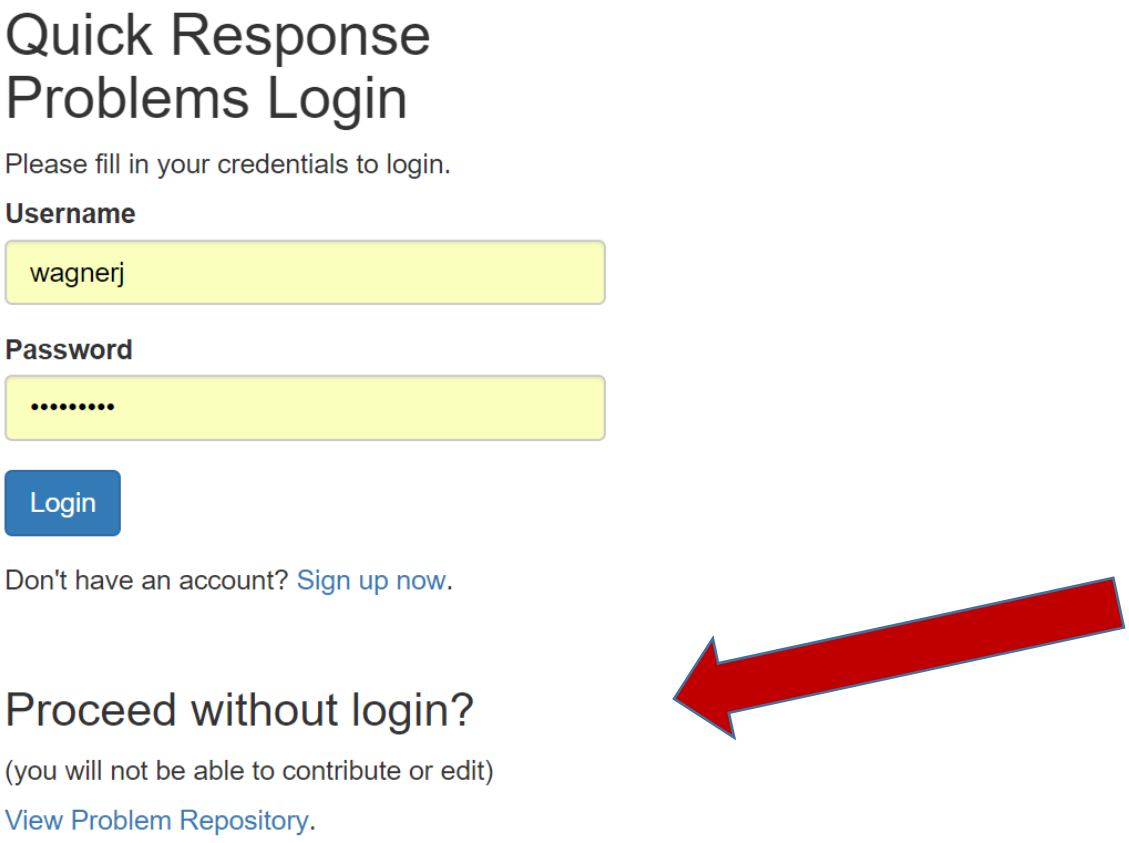
3) terms “base-case”, PIN and rtn Code mean

Questions?

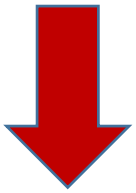
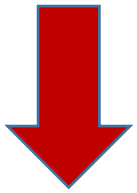
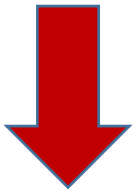
What Instructor does to use QRProblems

Instructor Selects Problems

Go to QRproblems.org/login



Filter Data Base and Preview Problems

Thermodynamics	Concept 1	Concept 2	Title	Status	LearnChemE	Functions	Base-Ca
Thermodynamics	First Law	Ideal Gas	Enthalpy Change for IG	New Compl	LearnChemE	Download	PreView
Thermodynamics	First Law	Ideal Gas	Isothermal Ideal Gas Compression	New Compl	LearnChemE	Download	PreView
Thermodynamics	First Law	Steam Tables	Isobaric heating of steam	New Compl	LearnChemE	Download	PreView
Thermodynamics	First Law	Ideal Gas	Reversible adiabatic expansion of an IG	New Compl	LearnChemE	Download	PreView
Thermodynamics	First Law	Ideal Gas	Reversible adiabatic expansion of an IG	New Compl	LearnChemE	Download	PreView
Thermodynamics	First Law	Ideal Gas	Continuous Adiabatic compression of an ideal gas	New Compl	LearnChemE	Download	PreView
Thermodynamics	First Law	Ideal Gas	Continuous Adiabatic compression of an ideal gas	New Compl	LearnChemE	Download	PreView
Thermodynamics	entropy change	Ideal Gas	Entropy change of ideal gas	New Compl	LearnChemE	Download	PreView
Thermodynamics	entropy change	Ideal Gas	Entropy change of ideal gas	New Compl	LearnChemE	Download	PreView
Thermodynamics	entropy change		entropy change for	New Compl	LearnChemE	Download	PreView

Pick out the Reflection / Short Answer Questions for the Problem

The following short answer / reflection questions are available with this problem

i) Reflect – Expert problem solvers reflect on the process. Describe in words your problem-solving methodology and your ability to solve this problem. Some questions you may want to consider include:

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- Were you stuck on one part? What process was effective in getting unstuck?
- Did you use a well-defined problem-solving algorithm? If not, why not?
- Did you start early enough to give yourself time to step away from the problem and "incubate the problem"?
- If you could give advice to your former self regarding this problem, or homework set, what would it be?

ii) Explore – How would you expect the efficiency to change in magnitude and direction if the boiler pressure were increased by 1 MPa leaving everything else constant. What are some theoretical and practical limits of using steam as the working fluid? Cite any sources used.

iii) Connect – Compare the output of this system to a typical powerplant. What is the closest powerplant to your home? What fuel source does it use? Find the typical boiler pressures used commercially and compare these to the values in the problem statement. What are some typical efficiencies for operating power plants. Compare the required cooling water flowrate to that of a fire hydrant. Please cite all references.

iv) Safety & Society – Look over an article regarding the generation of power such as : https://en.wikipedia.org/wiki/Thermal_power_station. List at least three things that you find interesting but did not know about power generation. Comment on the sources of fuel for power generation. Which fuel sources dominate the market? Has this been changing? Cite all sources besides the one given.