

Designing digital learning environment by merging a dynamic mathematics system and a computer-aided assessment system

Augusta Ratiu, Florin Sofonea and Mirela Vinerean



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Background

Continuous assignments have become increasingly common thanks to an intensive development of digital solutions in the form of computer aided assessment systems, where students receive direct feedback.

> However, the feedback given is often limited to **right or wrong**, sometimes with the correct answer added. In this way, students are not offered feedback that can function **formatively**.





Background

One purpose of the Erasmus+ project Pythagoras is to design tasks with customized automatically generated formative feedback.

To make this possible, we combine a computeraided assessment system (STACK) with a dynamic mathematics software (GeoGebra).

This requires carefully thought out assignments and well-crafted feedback based on student response. Although there is a lot of research on both of these digital tools individually, there are still only few studies focusing on a combination of them.





STACK | The University of Edinburgh



What STACK does

STACK (the **S**ystem for **T**eaching and **A**ssessment using a **C**omputer algebra **K**ernel) is an online assessment package for mathematics. This open-source system helps you build sophisticated assessments for STEM which challenge your students and provides feedback to help them improve their performance and understanding.

- STACK demonstration site
- STACK questions include:
 - Full algebraic input with validation and feedback
 - Multi-choice questions
 - Line by line reasoning
 - Dimensional numerical quantities







Math questions often have to be multiple choice questions, but with the STACK question type, students can enter direct math answers into Moodle.

STACK questions can have several parts and each part can be assessed separately. STACK questions can also include randomly generated components, which makes it much easier to create a series of practical questions and also prevent students from collaborating during a test.

Staff feedback options are now essential. Student responses can be assessed on the basis of a series of tests, with feedback and different grades returned to students based on test results.





Our focus



Design of adaptive feedback

Implementation In STACK





Examples of type of tasks



In mathematics education, examples play a key role.

Watson and Mason (2005) advocate asking students to construct their own examples as a powerful pedagogical tool in the learning of mathematics.

The richness of students' example space can serve as an indicator of their mathematical understanding.





Examples of formative feedback

Silent recorded demonstrations

GeoGebra visualization

Multiple choice question that help the student to reflect

Depending on the type of answer, give a new easier question that can help.









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STACK offers the possibility to introduce at the beginning of the evaluation a theoretical part that will give the student a short recapitulation that will help in obtaining a maximum score.

Information

Definition: A sequence of real numbers is a function $f : \mathbb{N} \to \mathbb{R}$, $f(n) = a_n$ or $f : \mathbb{N} \setminus A \to \mathbb{R}$, where $A \subset \mathbb{N}$ finite, $f(n) = a_n$. Notation: (a_n) is the sequence defined by the function f.

Definition: A sequence of real numbers (a_n) is increasing (decreasing) if $a_n \le a_{n+1}$ ($a_n \ge a_{n+1}$), $\forall n \ge 0$. If the above inequalities are strictly, then the sequence is called strictly increasing (strictly decreasing).

To study the monotony of a sequence (a_n) , the sign of the difference $\Delta a_n = a_{n+1} - a_n$ can be establish or to compare the ratio $\frac{a_{n+1}}{a_n}$ with 1, when $a_n > 0$, $\forall n \ge 0$.





After completing the theoretical parts, the student can complete the questions from the evaluation test.

There are several types of STACK questions that can be assigned to students to test the level of knowledge related to a subject.

Investigate, by using GeoGebra, how the graph of the trigonometric function f(x) = ALet $f : \mathbb{R} \to (0, \infty), f(x) = e^{-2x}, g : (0, \infty) \to (1, \infty), g(x) = \frac{1}{e^{-2x}}$ and sin(B(x + C)) + D, depends on the values of the parameters A, B, C and D. $h: (0, \infty) \to \mathbb{R}, h(x) = -\frac{1}{2}lnx$. Which of the following statement(s) is/are true? a) Describe in what way the various parameters alter the graph. o a. g and h are inverses of each other. A۲ BI 8 55 \odot 🔚 H-P 10 00 l b. f and h are inverses of each other. c. f and g are inverses of each other. \bigcirc d. None of f,g or h are inverses of each other. Let $f: (0, \infty) \rightarrow (0, 1)$, $f(x) = e^{-2x}$, $g: (0, \infty) \to (1, \infty)$, $g(x) = \frac{1}{e^{-2x}}$ and $h: (0, \infty) \to \mathbb{R}$, $h(x) = -\frac{1}{2}lnx$. Determine the following composite functions: a) $(f \circ g)(x) = f(g(x)) =$ Compute the solutions for the equation: $3 \cdot y^2 - y - 1 = 0$ b) $(f \circ h)(x) = f(h(x)) =$ [y = , y =]c) $(h \circ f)(x) = h(f(x)) =$





Students input equations directly into Moodle and can see a preview before they submit, and can receive feedback for each individual answer to the question

Tidy STACK

Let $(s_n) = \left\{ \frac{P_k(n)}{Q_i(n)}, n \in \mathbb{N} \right\}$ a sequence such that $P_k(n)$ and $Q_i(n)$ are two polynomyal of degrees $k \leq 3$ respectively. Give an example of a sequence s_n such that sequence is a) divergent;

-(2*n^3)+5*n+1

Your last answer was interpreted as follows:

 $-2 \cdot n^3 + 5 \cdot n + 1$

The variables found in your answer were: [n]

b) convergent to zero;

{-(2*n^2)+5*n+1}/{n^3-27}

Your last answer was interpreted as follows:

$$\frac{-2 \cdot n^2 + 5 \cdot n + 1}{\{n^3 - 27\}}$$

The variables found in your answer were: [n]

c) convergent to $\frac{3}{5}$.

{6*n^3+5*n+1}/{10*n^3-1}

Your last answer was interpreted as follows:

 $\frac{\{6 \cdot n^3 + 5 \cdot n + 1\}}{\{10 \cdot n^3 - 1\}}$

The variables found in your answer were: [n]



the European Union

Let $(s_n) = \left\{ \frac{P_k(n)}{Q_k(n)}, n \in \mathbb{N} \right\}$ a sequence such that $P_k(n)$ and

 $Q_i(n)$ are two polynomial of degrees $k \leq 3$ respectively. Give an example of a sequence S_n such that sequence is a) divergent;

-(2*n^3)+5*n+1

Your last answer was interpreted as follows:

$$-2 \cdot n^3 + 5 \cdot n + 1$$

TIUV STACK QUESTION TOOLT

The variables found in your answer were: [n]

X Incorrect answer.

Consider the sequence (s_n) , $s_n = \frac{a_k n^k + a_{k-1} n^{k-1} + \dots + a_1 n + a_0}{b_k n^i + b_{k-1} n^{i-1} + \dots + b_k n + b_0}$

 (s_n) is divergent if k > i

For example:

 $(s_n), s_n = \frac{-2n^3 + 5n + 1}{n^2 - 4}, n \in \mathbb{N}$ is divergent, $\lim_{n \to \infty} s_n = -\infty$





b) convergent to zero;

{-(2*n^2)+5*n+1}/{n^3-27}

Your last answer was interpreted as follows:

$$\frac{[-2 \cdot n^2 + 5 \cdot n + 1]}{\{n^3 - 27\}}$$

The variables found in your answer were: [n]

Correct answer, well done.



 \geq Question variables (optional) – In the following example, the variables ta1, ta2, ta3 represent the correct answers provided by the teacher, against which the student's responses will be checked.

Question variables

ta1:{-2*n^3+5*n+1}/{n^2-4}: ta2:{-2*n^2+5*n+1}/{n^3-27}: ta3:{6*n^3+5*n+1}/{10*n^3-1}; S 12 2 ¢, ì 55 ≣ A • В l \succ Question text M H-P

> Let \((s n)=\left\{\frac{P k(n)}{Q i(n)}, n\in\mathbb{N}\right\}) a sequence such that \(P k(n)\) and \(Q i(n)\) are two polinomyal of degrees \(k\leq 3\) respectively.

Give an example of a sequence \(s n\) such that sequence is a) divergent; [[input:ans1]] [[validation:ans1]][[feedback:prt1]]

b) convergent to zero; [[input:ans2]] [[validation:ans2]][[feedback:prt2]]

c) convergent to \(\frac{3}{5}\). [[input:ans3]] [[validation:ans3]][[feedback:prt3]]





➢Input answers: ans1, ans2, ans3, etc



> Input: ans1

- > Input: ans2
- > Input: ans3
- > Potential response tree: prt1
- > Potential response tree: prt2
- > Potential response tree: prt3

Potential response tree for each answer

Node 1	0	Answer test AlgEquiv SAns ans1 TAns ta1
		Test options Quiet No 🗢
Node 1 when true	0	Mod = + Score 1 Penalty Next [stop] + Answer note prt1-1-T
Node 1 true feedback	0	
Node 1 when false	0	Mod = + Score 0 Penalty Next [stop] + Answer note prt1-1-F
Node 1 false feedback	0	1 A ▼ B I ≔ ≡ ≡ ∞ % № ⊡ № № № № №
		Consider the sequence \((s_n),s_n=\frac{a_kn^k+a_{k-1}n^{k-1}+\ldots+a_1n+a_0}{b_i n^i+b_{i-1}n^{i-



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➢Potential response tree for each answer - this is where formative feedback comes:

- for whatever the student's answer is, we can give him feedback, either for the correct answer, partially correct or for the wrong answer
- if the student answered correctly, we can send him a feedback with the solution proposed by the teacher, and in case of a wrong answer, he will receive the correct answer and the related solution.

Node 1	0	Answer test	AlgEquiv AlgEquiv SAns ans1 TAns ta1
		Test options	Quiet No 🗢
Node 1 when true	0	Mod = 🗢	Score 1 Penalty Next [stop] Answer note prt1-1-T
Node 1 true feedback	0	I A.	· B I ≔ ≡ ≡ ∞ % № ■ • • • +•
		Correct answ	er, well done!
Node 1 when false	0	Mod = 🗢	Score 0 Penalty Next [stop] + Answer note prt1-1-F
Node 1 false feedback	0	I A.	· B I ≔ ≡ ≡ ∞ % № № № № № № №
		Consider the	sequence \((s_n),s_n=\frac{a_kn^k+a_{k-1}n^{k-1}+\ldots+a_1n+a_0}{b_i n^i+b_{i-1}n^{i-





There are questions where the answer can be written in several forms. At the time of implementation, the teacher must provide all forms of correct answers. For example, the following variables constitute all forms of correct answer:





Implementing the tree related to the correct answers:







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In the stack there are several types of questions that can be implemented:

- Multiple choice allows the selection of a singular o multiple responses from a pre-defined list
- True/False a simple form of multiple choice question with just the two choices "True" and "Fals"
- Matching the answer to each of a number of subquestion must be selected from a list of possibilities
- Essay allows a response of a file upload and/or online text. This must then be graded manually
- Drag and drop into text STACK provides mathematical questions for the Moodle quiz. These use a computer algebra system to establish the mathematical properties of the student's responses.
- Select missing words missing words in the question text are filled in using drop-down menus
- STACK STACK provides mathematical questions for the Moodle quiz. These use a computer algebra system to establish the mathematical properties of the student's responses.





True/False – a simple form of multiple choice question with just the two choices "True" and "Fals"

Determine whether the following relation is a function $\{(2, 1), (3, 2), (-1, 1), (0, 2)\}$

Select one:

True

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💿 False 🗙

We can consider the function $f(x) = ax^3 + bx^2 + cx + d$, where a, b, c, d can be determined from the conditions:

 $\begin{cases} f(2) = 1\\ f(3) = 2\\ f(-1) = 1\\ f(0) = 2 \end{cases}$

The correct answer is 'True'.

Determine whether the following relation is a function $\{(2, 1), (3, 2), (-1, 1), (0, 2)\}$

Select one:

💿 True 🗸

False

Well done!

The correct answer is 'True'.





Implementation of the True/False question type:

Correct answer

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True 🖨

Feedback for the response 'True'.

Feedback for the response 'False'.



We can consider the function $(f(x)=ax^{3}+bx^{2}+cx+d)$, where (a), (b), (c), (d) can be determined from the conditions:

\(\begin{cases} $f(2) = 1 \setminus f(3) = 2 \setminus f(-1) = 1 \setminus f(0) = 2 \in \{cases\}$)





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Implementation of the STACK question type: Give examples of sets $V_1 \in v$ (1) and $V_2 \in v$ (0) such that $V_1 \cap V_2 \neq \emptyset$ 1. $V_1 =$ 2. $V_2 =$ The stack code: Give examples of sets \(V_{1}\in\) \(\upsilon\) (1) and \(V_2\in\) \(\upsilon\) (0) such that \(V_1\cap V_2\neq\) \ (\varnothing\) 1. \(V_1\) = [[input:ans1]] [[validation:ans1]] [[feedback:prt1]] 2. \(V_2\) = [[input:ans2]] [[validation:ans2]] [[feedback:prt2]]

Input: ans2 Input: ans1 \sim Algebraic input Input type 0 Input type Algebraic input \$ 0 \$ Model answer (1-(1/10),1+(1/10))0 Model answer 0 (0-(1/100), 0+(1/100))**Co-funded by**

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Implementation of the STACK question type

Potential response tree: prt1

Question value		1
Auto-simplify	0	Yes 🗢
PRT feedback style	0	Formative +
Feedback variables	0	

This potential response tree will become active when the student has answered: ans1



Node 1	0	Answer test	AlgEquiv 🗘	SAns ans1	TAns	ta1	
		Test options	Quiet No 🕈				
Node 1 when true	0	Mod = 🗢	Score 1 Penalty	Next [stop] + Answe	er note	prt1-1-T	
Node 1 true feedback	0	I A-		• • • •	•	■ 🖄 H-P	0
		Well done!					
Node 1 when false	0	Mod = 🗢	Score 0 Penalty	Next [stop] + Answe	er note	prt1-1-F	
Node 1 false feedback	0	I A-			e l	■ 🖄 H-P	•
		- remember t	them the definitions of the	neighborhood of a point and dis	joint set	S	





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Implementation of the STACK question type

✓ Potential response tree: prt2

Question value		1
Auto-simplify	0	Yes 🗢
PRT feedback style	0	Formative +
Feedback variables	0	

This potential response tree will become active when the student has answered: ans2



Node 1	0	Answer test AlgEquiv SAns ans2 TAns ans2 ta2
		Test options Quiet No 🗢
Node 1 when true	0	Mod = + Score 1 Penalty Next [stop] + Answer note prt2-1-T
Node 1 true feedback	0	
		Well done!
Node 1 when false	0	Mod = + Score 0 Penalty Next [stop] + Answer note prt2-1-F
Node 1 false feedback	0	
		- represents on the axis of real numbers the neighborhood of a point \(a\)





Another type of question(STACK question): within the statement, you can also insert the graph related to the problem, and the students input equations directly into Moodle, and can see a preview before they submit.

Let $f(x) = k(x + a)^2 + b$ be a quadratic function.

Investigate, how the graph of the function depends on the values of the parameters a, b and k.

d) The figure below shows the graph y = f(x) of a quadratic function f. Use the method that you described in prompt c) to determine f. Use the method that you described in prompt c) to determine f.



Your last answer was interpreted as follows:

$$2 \cdot x^2 + 4 \cdot x - 1$$

The variables found in your answer were: [x]





Types of questions: Multiple choice question

This type of question allows students to choose as an answer one or more of the items and has the possibility to access GeoGebra to calculate the correct answer.

For this type of question, for each student the items can be generated randomly, so that the items a, b, c, d are always in a different order. Give an example of a sequence:

 $(s_n) = \frac{an+b}{cn+d}$, $n \in \mathbb{N}$, where $a, b, c, d \in \mathbb{R}$ such that the sequence is:

a) increasing and convergent to 3;

b) decreasing and convergent to 3.

Use GeoGebra to check your sequences before you answer.

https://www.geogebra.org/calculator

Select the correct answer:

□ a. sequence (s_n) is decreasing to 3 if a = 3c, $ad \leq bc$

□ b. sequence (s_n) is increasing to 3 if a = 3c, $ad \ge bc$, $\frac{d}{c} \ge 0$

□ c. sequence (s_n) is increasing to 3 if $a = 3c, ad \ge bc$

□ d. sequence (s_n) is decreasing to 3 if a = 3c, $ad \le bc$, $\frac{d}{c} \ge 0$

Check





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At the time of implementation, you can choose the subtype of the question: 1 single correct answer or multiple correct answers







Depending on this attribute, the answers will be distributed and the total score of 100 points. Example: if there are two answers, 50 points will be distributed for each answer, if there is only one correct answer, all the points will be awarded

	\((-\infty ,-5)\cup
Grade	✓ None
	100%
Feedback	90%
	83.33333%
	80%
	75%
	70%
Choice 2	66.66667%
	60%
	50% (5
	40%
Grade	33.33333%
	30%
Feedback	25% B
	20%
	16.66667%
	14.28571%
Obsiss 2	12.5%
Choice 3	11.11111% B
	10%
	5%

Answers

Choice 1







Answers

If the question has more than one answer, the score must be divided according to how many correct items it has, so that if the student chooses only part of the correct answer, feedback for the partial answer will be sent to him.

Choice 1 Α-BI 8 55 Image: A start of the start ሮብ ዙ•ዎ 1 sequence (\(s_n\)) is increasing to \(3\) if \(a=3c, ad\geq bc\) Grade None ŧ Feedback BI A۳ S 55 1 ሮ | ዙም Choice 2 В ବ୍ତ SS ≣ 12 ¢. °21 H-⊅ l A • I sequence (\(s_n\)) is decreasing to \(3\) if \(a=3c, ad\leq bc\) Grade None ŧ Feedback 00 BI 55 Image: A start a st 💌 🖓 ዙ-P 1 Α-Choice 3 Ţ В I ≣ S 55 CA H-2 Α-12 sequence (\(s_n\)) is increasing to \(3\) if \(a=3c, ad\geq bc\), \(\frac{d}{c}\geq 0\) 50% Grade ŧ Feedback В 8 S 1 A۳ I Image: A start a st ₽́] H-9 Choice 4 l Α-В ≣ 12 € Ţ ବ୍ତ SS <u> የ</u> በ በ sequence (\(s_n\)) is decreasing to \(3\) if \(a=3c, ad\leq bc\), \(\frac{d}c}\geq 0\) 50% Grade ŧ Feedback $\mathbf{A} \bullet \mathbf{B} \mathbf{I}$ ବ୍ତ 55 Ţ. <u>.</u> Image: A start of the start <u>ଜ</u>ା ୫୫୫





For this question, depending on the student's answer, we implemented formative feedback for:

Combined feedback

For any correct response

For any partially correct

- correct answer

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- partially correct answer
- incorrect answer

Your answer is correct. Consider the sequence \((s_n),s_n=\frac{an+b}{cn+d}\). \((s_n)\) is increasing if \(ad\geq bc, \frac{d}{c} \geq 0\) Image: A region B I Image: Im		H-7
Consider the sequence $\langle (s_n), s_n = \frac{\pi c_a + b}{c_n + d} \rangle$. $\langle ((s_n) \rangle$ is increasing if $\langle ad geq bc, \frac{r}{c_a + b}{c_a + b} \rangle$ $\mathbf{A} = \mathbf{B} \mathbf{I} \cong \mathbf{E} \mathbf{E} \mathbf{E} \mathbf{E} \mathbf{E} \mathbf{E} \mathbf{E} \mathbf{E}$	Your answer is correct.	
$ ((s_n)) \text{ is increasing if } (ad \geq bc, \frac{d}{c} \geq 0) $ $ \mathbf{A} = \mathbf{B} I \implies \mathbf{\Xi} \equiv \mathbf{\Xi} \otimes \mathbf{S} \implies \mathbf{B} \mathbf{B} \mathbf{B} \mathbf{B} \mathbf{B} \mathbf{B} \mathbf{B} \mathbf{B}$	Consider the sequence \((s_n),s_n=\frac{an+b}{cn+d}\).	
Image: Argenting and B Image: Imag	\((s_n)\) is increasing if \(ad\geq bc, \frac{d}{c} \geq 0\)	
		τr
	Theory: A sequence ((s_n)) is increasing (decreasing) if $(s_{n+1}) \ge n$), ((forall n in)) \
Theory: A sequence ((s_n)) is increasing (decreasing) if $(s_{n+1} \ge n)$, ($forall n in$) ((\mathbb{N}\), (\(s_{n+1}\leq s_n\), \(\forall n\in\)\(\mathbb{N}\)).	

Options

response

Show the number of correct responses once the question has finished

 For any incorrect response

 Image: A market B

 Image: A market B
 </t





Multiple choice question – formative feedback

Your answer is partially correct.

Theory: A sequence (s_n) is increasing (decreasing) if $s_{n+1} \ge s_n$, $\forall n \in \mathbb{N}$, $(s_{n+1} \le s_n, \forall n \in \mathbb{N})$.

 $\lim_{n \to \infty} s_n = \lim_{n \to \infty} \frac{a + \frac{b}{n}}{c + \frac{d}{n}} = \frac{a}{c} = 3, a = 3c, c \neq 0$ Approach: $s_{n+1} - s_n = \frac{ad - bc}{(cn + c + d)(cn + d)} = \frac{c(3d - b)}{c^2(n + 1 + \frac{d}{n})(n + \frac{d}{n})}$

We consider the function $f : \mathbb{R} \setminus \left\{-\frac{d}{c}\right\} \to \mathbb{R}$, $f(x) = \frac{ax+b}{cx+d}$ for study of monotony; $f'(x) = \frac{ad-bc}{(cx+d)^2}$. For example (s_n) , $s_n = \frac{24n-67}{8n-20}$, $n \in \mathbb{N}$ we have $ad - bc \ge 0$, but it is not increasing because

 $s_3 - s_2 < 0, s_3 - s_1 < 0, s_{n+1} - s_n > 0, \forall n \in \mathbb{N} \setminus 2.$

Using GeoGebra, we can represent the graphic of function $f(x) = \frac{24x-67}{8x-20}$, $x \in \mathbb{R} \setminus \left\{\frac{5}{2}\right\}$ and it si observed that $x = \frac{5}{2}$ is the vertical asymptote.



In conclusion, the function must have the vertical asymptote $x = -\frac{d}{c} \leq 0$.

In conclusion, the function must have the vertical asymptote $x = -\frac{d}{c} \le 0$. For example $(s_n), s_n = \frac{18n+15}{6n-11}, n \in \mathbb{N}$ we have ad - bc < 0, but it is not decreasing because $s_2 > s_1, s_{n+1} < s_n, \forall n \in \mathbb{N} \setminus \{1\}.$

Using GeoGebra, we can represent the graphic of function $f(x) = \frac{18x+15}{6x-11}, x \in \mathbb{R} \setminus \left\{\frac{11}{5}\right\}$.



In conclusion, the function must have the vertical asymptote $x = -\frac{d}{c} \le 0$. You have correctly selected 1. The correct answers are:

sequence (s_n) is increasing to 3 if $a = 3c, ad \ge bc, \frac{d}{c} \ge 0$ sequence (s_n) is decreasing to 3 if $a = 3c, ad \le bc, \frac{d}{c} \ge 0$





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Questions with variable values

When creating the code related to the questions, in the field related to the answer, we can suggest the form of the answer to the student, so as to help him in obtaining the correct answer.



Compute the solutions for the equation:
$$-2 \cdot x^2 + 9 \cdot x - 4 = 0$$

[x1 = 4 ,x2 = 1/2]

Your last answer was interpreted as follows:

$$\left[x_1 = 4, x_2 = \frac{1}{2}\right]$$

The variables found in your answer were: $[x_1, x_2]$





Identify the section where you want to enter the test (for example, the current week) and add a new activity (Add an activity or resource) of the grid test type (Quiz)

Add an activity or resource



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Adding a new Quiz to Evaluation

Complete the requested data about the new created test:

- In the General section:
 - The name of the test (Name), a field that will also appear on the main page of the discipline;
 - Description of the test (Description), a field that can appear on the main page of the discipline if you check the appropriate box below the description;



Display description on course page ?

- > Timing
- > Grade
- > Layout
- > Question behaviour
- > Review options @
- > Appearance
- > Safe Exam Browser
- > Extra restrictions on attempts
- > Overall feedback •



- > In the Timing section:
 - Date and time when the test becomes available to students (Open the quiz);
 - Date and time when the test becomes unavailable to students (Close the quiz). Attention: if students are still working at that time, the test will be closed automatically;

- In the Layout section:
 - How to display the questions (New page). We recommend using the way in which all questions are displayed on the same page (Never, all questions on one page) so that the number of interactions with the Moodle server is minimal;

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➤ In the Question behavior section:

- Opt for mixing answers within a question (Yes) or for keeping the order of the answers within the questions (No). We recommend mixing the answers like this make it harder for students to communicate their answers to questions;
- In the Review Options section:
 - We recommend unchecking The • attempt box in the last two columns (Later, while the quiz is still open, respectively After the quiz is closed) to prevent students from viewing the grid (the questions and correct quiz answers) after they have completed the assessment. Students will only be able to this information view immediately after the assessment is complete (approximately 5 minutes). Students will also be able to view their grade at any point in time after completing the assessment.

Question behaviour



Show more...

✓ Review options Ø

- During the attempt The attempt ? Whether correct ? Marks ? Specific feedback ? General feedback ? Right answer ?
- Overall feedback 💡
 - Later, while the quiz is still open
- The attempt
- 🗹 Whether correct
- 🗹 Marks
- Specific feedback
- General feedback
- Right answer
- 🗹 Overall feedback

Immediately after the attempt

- 🗹 The attempt
- Whether correct
- 🗹 Marks
- 🗹 Specific feedback
- 🗹 General feedback
- 🗹 Right answer
- Overall feedback
 - After the quiz is closed
- The attempt
- Whether correct
- Marks
- Specific feedback
- General feedback
- Right answer
- Overall feedback



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 In the Extra restrictions on attemps section:
 From this section

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you can configure a password for accessing the test (to set it, press the Pencil icon);

 Extra rest 	rict	lions on attempts	
Require password	0	Test 🖋 🔍	
Show less			
Require network address	0		
Enforced delay between 1st and 2nd attempts	0	0 minutes 🗢 🗆 Enable	
Enforced delay between later attempts	9	0 minutes 🗢 🗆 Enable	
Browser security	0	None	\$
Allow quiz to be attempted offline using the mobile app	0	No 🕈	



Save the changes and enter the stage of adding questions to the test. After you have created the test, it is time to assign it to the students enrolled in the course.

The student will know from the beginning between which dates and times he will be able to solve the test and how much time he has available from the moment the test starts until its completion.







Students will access the test using the password provided, and begin the test.

Start attempt

 \times

Password

To attempt this quiz you need to know the quiz password

Quiz password

?~

Time limit

Your attempt will have a time limit of 40 mins. When you start, the timer will begin to count down and cannot be paused. You must finish your attempt before it expires. Are you sure you wish to start now?

Start attempt Cancel



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The remaining time for solving the problems will be displayed on the page of each question, so that at any moment the student will be able to see how much time he has until the end of the test.









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Time left 0:39:16

Question 2 Not yet answered Marked out of 1.00	Graph the linear function $f(x) = -x + 6$. 1 $\mathbf{A} \cdot \mathbf{B}$ $\mathbf{I} \coloneqq \mathbf{E} \mathbf{E} \mathbf{E} \mathbf{E} \mathbf{E} \mathbf{E}$ Compared to the set of the s
question Edit question	geogebra.org
	Maximum file size: 40 MB, maximum number of files: 1
	□ ■ Files
	You can drag and drop files here to add them
	Accepted file types
	Image files to be optimised, such as badges .gif .jpe .jpeg .jpg .png

Previous page

Next page





To complete the test, the student will press Finish attempt..., placed in the lower right area of the page.

A summary of the answers is presented before the test is completed; At this point, the student can see the questions he has not answered yet, as well as how much time he has left.

Test Functions

Summary of attempt

Question	Status
1	Not yet answered
2	Answer saved
3	Not complete
4	Not complete
5	Not complete
6	Not complete
7	Not complete
8	Not complete

If he wants to complete, he will press Submit all and finish, followed by a confirmation from him.

Confirmation

×

Once you submit, you will no longer be able to change your answers for this attempt.







Stack implementation in other areas

The applicability of evaluation systems with integrated learning with feedback shows its benefits, for example, a module that helps students prepare for a license exam. Within it, the test has integrated formative feedback that helps the student to deepen the subject, in cases where the answers are correct, giving details on alternative methods, and in case some notions are not known, to explain in a personalized way what exactly it has to learn, why he had inadvertences in his answers and what connections he needs to make in order to understand the scientific links between the component parts of the subject matter to be studied.

All this transcribes the difficulty of the learning process for content creators for such tests, whose experience is fundamental in creating such quality content.

Question text

<pre>What values will the following program display? int x = 9, y = 5, a, b, c; b = a = x++; y++; c = x + y; b = (++y) + a; printf("\n%d %d %d", a, ++b, c);</pre>
a = [[input:ans1]] [[validation:ans1]][[feedback:prt1]]
b = [[input:ans2]] [[validation:ans2]][[feedback:prt2]]
c = [[input:ans3]] [[validation:ans3]][[feedback:prt3]]

Tidy STACK question What values will the following program display? int x = 9, y = 5, a, b, c; b = a = x++; y++; c = x + y; b = (++y) + a; printf("\n%d %d %d", a, ++b, c); a = _____ b = _____ c = ____ Check





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Formative Feedback for previous Stack Questions

Standard feedback for correct	
	✓ Correct answer, well done.
	You have carefully analyzed each step of the code and correctly calculated the values of the variables a, b, and c. It is essential to understand how the assignment and increment operators work in the context of complex
	expressions and to pay attention to the order in which these operations are performed.
	An important point that you illustrated with this problem is how the increment (++) and assignment (-) operators can influence the values of variables and the final output of the program
	an important point that you indicated with this problem is now the increment (1) and assignment (2) operators can immediate the function of the program.
Standard feedback for partially correct	
	O Your answer is partially correct
Standard feedback for incorrect	
	X Incorrect answer.
	int x = 9, y = 5, a, b, c;
	b = a = x++;
	y++;
	c = x + y;
	b = (++y) + a;
	printf("\n%d %d %d", a, ++b, c);
	In this program, we will analyze the values that the variables a, b, and c will display at the end of execution, taking into account the initial values and the operations performed on them within the code.
	Initialization and assignment of values:
	int x = 9, y = 5, a, b, c;: We declare the variables x, y, a, b and c, and initialize the variables x and y with the values 9, 5.
	b = a = x++;: We assign the values of x to the variables a and b, and then increment x. So a gets the initial value of x, which is 9, and b gets the value of a.
	Incrementing y and calculating c:
	y++;: We increment y by 1, so y will become 6.
	c = x + y; We calculate the sum of x and y, which are now x=10 and 6, and store it in c. So c will be 16.
	Modification of b:
	b = (++y) + a;: We increment y by 1 (so y becomes 7) and add the value of a to y. Since a is 9, adding 9 to 7 gives 16.
	Display the result:

Finally, we display the values of a, ++b and c, but before displaying the value of b we will increment it by 1, making it 17.

Determination of values:

b: Calculated in the previous step as 17.c: It was previously calculated as 16.

a: Gets the value of x from the first assignment, so it will be 9.





Percentaged multiple type choice tests

Specify the displayed values, if the numerical values 5 2 -3 are to be read in the indicated order:

```
int main() {
    int a, b;
    scanf("%d%d%d", &a, &b, &a);
    printf("%d,", a);
    printf("%d,", b);
    printf("%d", a + b);
}

    a. there are syntax errors
    b. 5 2 7
    c. -3 2 -1
    d. 5 2 7
```

For this example there is only one correct answer, but, if we have more than one answer the grade of the answer will be divided in number of choice.





Combined Feedback for previous Multiple Choice Tests

✓ Combined feedback

For any correct response

Ъ Ат В І І І І І І І І № № № № № № № №

Your answer is correct.

You have used the scanf and printf functions correctly to read and display the read values, i.e. the sum of the first two numbers.

Explanations:

Function scanf("%d%d%d", &a, &b, &a); reads three integers from standard input. The last value read to overwrite the previous value of variable a.

The read values are then displayed using the printf function. So:

The variable a will display the last value read for a.

The variable b will display the value read for b.

The sum of the first two numbers, a + b, will display the sum of the values originally read for a and b.

If you enter the values 5, 2 and -3 in this order, the displayed values will be:

a: -3 (last value read for a)

b: 2

a + b: -1 (sum of initially read values for a and b: 5 + 2 = 7, but last read value for a was -3)

You have shown a clear understanding of how to use the scanf and printf functions.

For any incorrect response

↓ A • B I ≔ ≡ ≡ ≡ � % ◎ ⊡ ₽ ♥ ₽ № ₽ ₩ ₽ ♥

Your answer is incorrect.

In this code, a sequence of three integers is read using the scanf function, and then the values read and the sum of the first two numbers are displayed. Function scanf("%d%d%d", &a, &b, &a); is used to read three integers. Since the variable a is read twice, the last value read to overwrite the previous value of the variable a.

Then the read values are displayed using the printf function. In this case, the a variable, the b variable, and the sum of the first two numbers (a + b) are displayed.

If we enter the values 5, 2 and -3 in this order, following the instructions in the code:

The first value read is 5 and is stored in the variable a.

The second value read is 2 and is stored in the variable b.

The third value read is -3 and is stored again in the a variable, overwriting the previous value.

Thus, the displayed values will be:

a: -3 (last value read for a)

b: 2

a + b: -1 (sum of initially read values for a and b: 5 + 2 = 7, but last read value for a was -3)





O Matching questions

We consider the variables a, b, c, d and e. Write the correct version of the statements, so that the following assignments are not accompanied by conversions that modify the assigned values.



We consider the variables a, b, c, d and e. Write the correct version of the statements, so that the following assignments are not accompanied by conversions that modify the assigned values.



✓ Answers







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For previous question we have implemented the formative feedback for:

- Correct answer
- Partilly correct answer

Incorrect answer

 Combined feedback 	
For any correct response	
	Your answer is correct and demonstrates a solid understanding of data types and their correct use in C! You used the appropriate data types for the variables a, b, c, and d and assigned literal values without requiring implicit conversions to change the assigned values. By usin the appropriate data types and values correctly, you ensure accurate data storage in variables and avoid unwanted changes.
For any partially correct response	
	Your answer is partially correct. In the C language, data types are used to specify the nature of the data stored in variables and how they are interpreted by the program. Here is a full explanation for each data type mentioned in the given problem:
	The char data type is used to store characters and is represented by a single byte in memory. Char variables can store a single ASCII character or a special character. In o case, when we assign the value 'a' to the variable c, we store the ASCII code of the character 'a', which is 97. This ensures that the variable c will contain the ASCII value corresponding to the character 'a'.
	The double data type is used to store double-precision floating-point real numbers. Variables of type double are represented on 8 bytes in memory and provide higher precision than single-precision floating-point data types. When we assign the value -3.452 to the variable d, we store this value with double precision in memory.
	The int data type is used to store integers. Variables of type int are represented by 4 bytes in memory and can store integer values in the range specified by the data type When we assign the value 3 to the variable a, we store this value as an integer in memory.
	The float data type is used to store single-precision floating-point real numbers. Float variables are represented by 4 bytes in memory and provide lower precision than double data types, but take up less memory space. When we assign the value 2.1 to the variable b, we must add the suffix f to specify that the value is a float, like this: 2.1
	By using the correct data types and appropriate values, we ensure accurate data storage in variables and avoid implicit conversions that could change assigned values or affect data precision.
Ontions	Show the number of correct responses once the question has finished
For any incorrect response	
	Your answer is incorrect. In the C language, data types are used to specify the nature of the data stored in variables and how they are interpreted by the program. Here is a full explanation for each data type mentioned in the given problem:
	The char data type is used to store characters and is represented by a single byte in memory. Char variables can store a single ASCII character or a special character. In o







According to those illustrated, the combination of a virtualization system that allows the collaborative integration of software that shares data systems, and the implementation of a STACK system together with the Moodle platform, all these together, constitute a solid base on which systems can be built assisted learning, even in test modules. We return with the clarification that all this transfers the difficulty in the scientific design of the implementation and is based entirely on the ability of the teaching staff to understand the learning process and the technical mastery of pedagogical psychology.







Platform Services benefits

- answers contain mathematical content;
- generates random structured questions;
- stablish the mathematical properties of those answers;
- formative, summative and evaluative outcomes (i.e. feedback);
- stores all data for later analysis.
- Adaptability of online learning structures





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Guide for entering the answer

- $\Box \text{ for } \begin{bmatrix} 1 & 3 \\ 5 & 9 \end{bmatrix} \text{ should be entered as } matrix([1,3],[5,9])$
- \Box enter $\alpha + \beta$ as alpha + beta
- \Box 1 < x and x < 5, not 1 < x < 5
- □ for list 1, 2, 3, 3 type [1, 2, 2, 3]
- □ for set type {1,2,3}
- $\Box e^x \sin(bx)$ should be entered as $\exp(a * x) * \sin(b * x)$
- \Box *i* or *e* is entered as %*i* respectively %*e*
- $\Box x^2$ is entered as x^2

$$\Box \frac{3}{5x}$$
 is entered as $3/\{5 * x\}$





THANK YOU FOR YOUR ATTENTION!



