Étoile

Enhanced Technology for Open Intelligent Learning Environments

A short course on

Global Systems Science

Assessment – Lesson 2. Marking Guide.

General Guidelines

Word Count

The word count is included to make the assignments short enough to be marked in the time. The instructions clearly require the word count to be given for each part of the assignment. Deduct one mark from each or any of Questions 1 to 4 that have no word count. The instructions give 10% leeway on the word count. If the word count exceeds this deduct 1 mark for each extra 20 words.

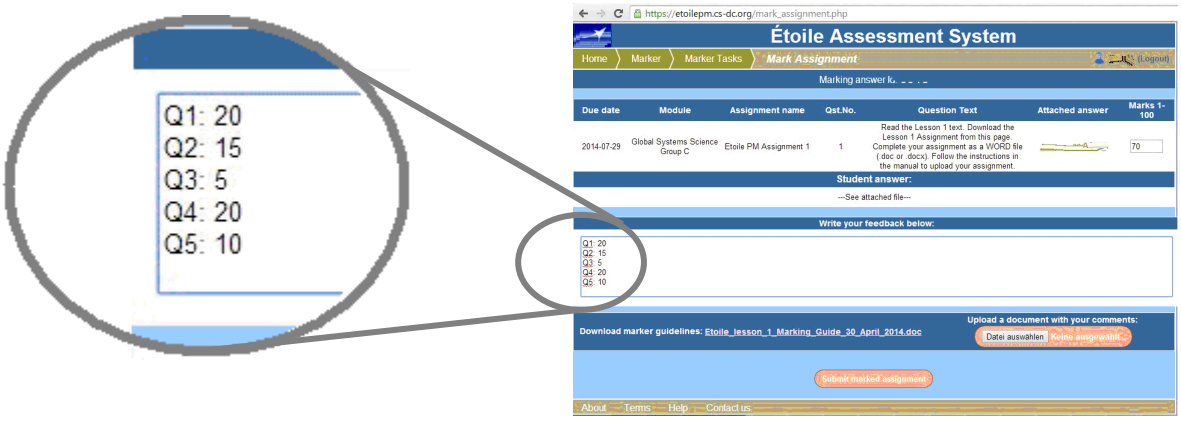
Plagiarism

Normally plagiarised answers get zero marks. However, here we have not warned against plagiarism, so do not deduct marks if you think the answer is plagiarised. However please inform Khadija or Saad if you think an answer or part has been plagiarised.

Awarding marks

All these questions have a maximum of 20 marks. You can award anything between 0 and 20, according to your application of the guideline.

Note that for marking you must enter the marks you gave for each question as shown below.



The Questions

Question 1 [Guideline 100 words] [20 marks]

Sketch a diagram illustrating a positive feedback loop not taken from the Lesson 2 text showing any time lags. Explain your diagram. Diagram text is not included in the word count.

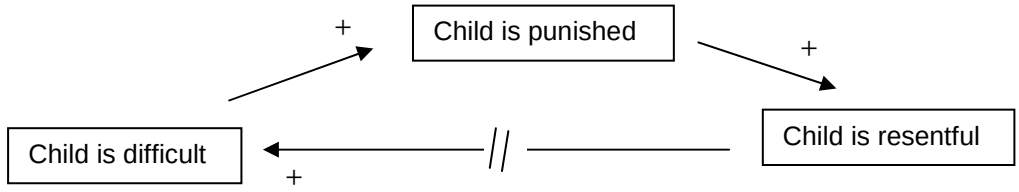
Marking Guide to Question 1 [Maximum 20 marks]

The answer must illustrate the idea that "positive feedback enhances or exaggerates change as things move round the loop".

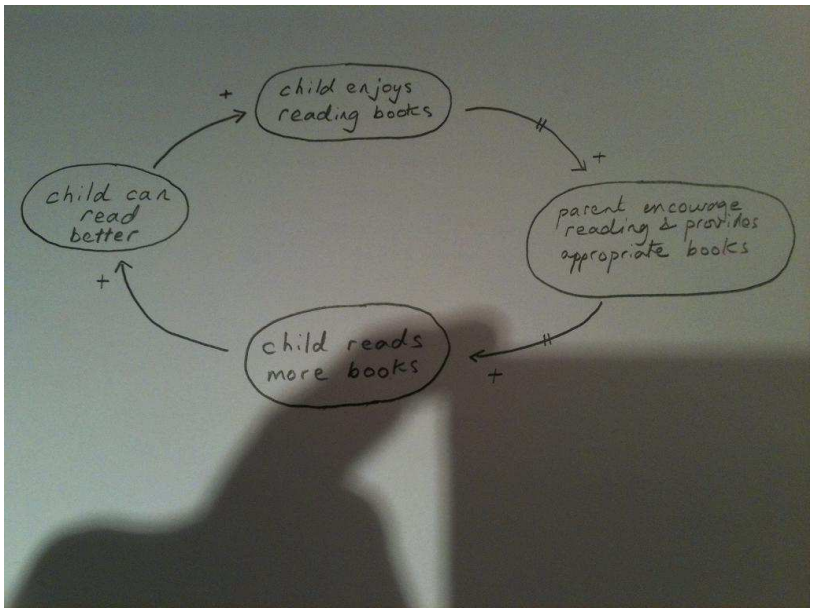
There are 10 marks for the diagram and 10 marks for the explanation.

Diagram. [10 marks] We are not testing student's ability to draw but testing their understanding of the ideas. Do not deduct marks if the diagrams are poor, provided they show what they should. Some students may scan or photograph hand-drawn diagrams. These images may be poor quality, *e.g.* Example 1(b) which shows my camera (phone) and figure, and is not cropped to a better size. This is acceptable as long as you can read the diagram.

Example 1(a)



Example 1(b)



(i) Award [4/10] marks for a diagram that shows a loop.

(ii) Award [3/10] for showing (correctly) where the loop has increasing affects. Using plus signs, +, the loop should show where there is an increase in affect. Not every arrow need have a plus sign, but at least one should.

(iii) Award [3/10] for a diagram that (correctly) shows a delay by two short parallel lines across the arrows, as appropriate.

Explanation [10 marks]. Award 10 marks for the explanation

The answer must explain the positive feedback process, as illustrated in the boxes below.

Example 1(a)

The child is being a little difficult. This causes the parent to punish the child mildly (an increase since there was no previous punishment, therefore a + sign on the arrow). The child feels resentful (an increase since it was not resentful before, therefore a + sign on the arrow). Later (as shown by two parallel lines on the arrow) the child is more difficult (+ sign on arrow) for which it punished more severely (+ sign on arrow). This causes greater resentment (+) which causes worse behaviour (+) which gets more severe punishment (+). The cycle of bad behaviour, punishment, and resentment gets worse and worse.

[107 words]

Example 1(b)

As a child learns to read it enjoys more reading books (plus sign on the arrow). This causes the parent to give encouragement and provide appropriate books (the encouragement could be instant, getting the books may have a delay, hence the two lines on the arrow). This enables the child to read more books (+) over time (two parallel lines since not necessarily instant). As a result of reading books the child's ability to read improves (+ on the arrow) and this enables them to enjoy reading more (+ on the arrow). This positive feedback loop is one of increasing enjoyment in reading causing and being caused by parental encouragement and facilitation.

[112 words]

Awarding marks for the explanation.

(i) Award up to [3/10] for a good explanation of the plus signs to show an increase in affect.

(ii) Award up to [3/10] for a good explanation of delays and using small parallel lines on arrows.

(iii) Award up to [4/10] for how well the example illustrates the concept of positive feedback. These examples implicitly or explicitly make assertions about cause and affect, *e.g.* "getting better at reading causes a child to enjoy reading more". I provided no evidence. You may have evidence to the contrary, but here treat the assertions as hypotheses. If they were empirically correct, the proposed positive feedback loop should be valid. The assertions should be reasonable, *e.g.* "carrying a knife makes you safer" is not true, it should be "carrying a knife makes you feel safer".

The two example above would score high marks. The first would score 20/20. The second has two small problems. First, in the photograph, in the right box the work "encourage" is missing the final "s" and should be "encourages". If this were the only such problem it could be overlooked and no marks deducted. If there were other grammatical or spelling error a mark should be deducted (more than one mark if there are a lot of errors) . The other problem is that the word count is 112, which is two more than the ten percent allowed. The first twenty extra words lose a mark, so one mark should be deducted. Thus, Example 1(a) would score 20/20 and Example 1(b) would score 19/20.

Question 2 **[**Guideline 100 words] [20 marks]

Sketch a diagram illustrating a negative feedback loop not taken from the Lesson 2 text showing any time lags. Explain your diagram. Diagram text is not included in the word count.

Marking Guide to Question 2 [Maximum 20 marks]

Diagram. [10 marks] Again, we are not testing student's ability to draw but testing their understanding of the ideas. Do not deduct marks if the diagrams are poor, provided they show what they should. Scanned or photograph hand-drawn diagrams may be poor quality.

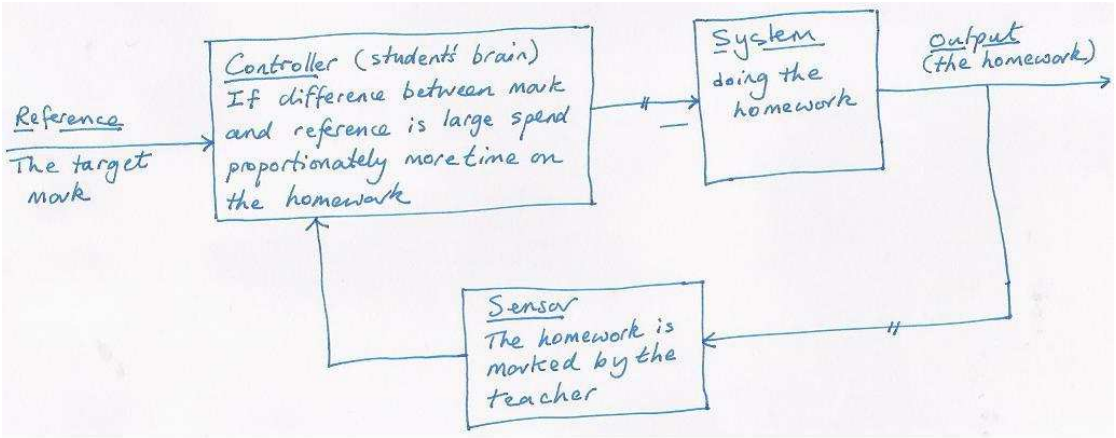
(i) Award [4/10] marks for a diagram that shows a loop including a 'reference' of some kind. The reference is implicit in Example 3(b) as "the difference between the *desired* and actual mark" (deduct two marks if no explicit or implicit reference).

(ii) Award [3/10] for showing (correctly) where the loop has decreasing affects. Using minus signs, – , the loop should show where there is a decrease in affect. Not every arrow need have a minus sign, but at least one should.

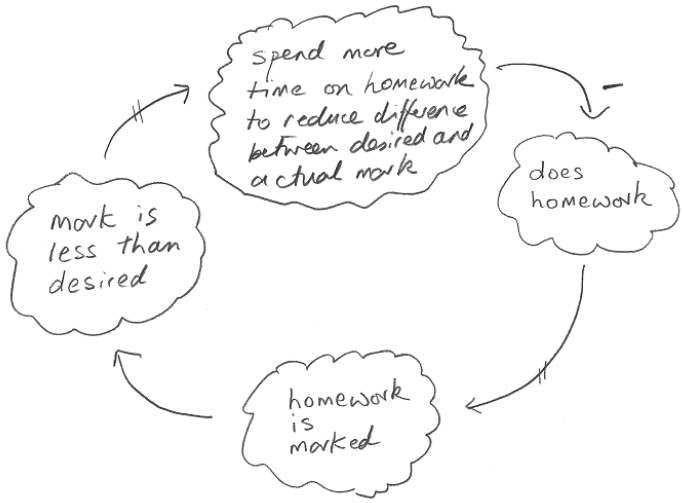
(iii) Award [3/10] for a diagram that (correctly) shows a delay by two short parallel lines across one or more arrows, as appropriate.

Examples 2(a) and 2(b) would both get full marks as a diagram. The first is like an engineering control diagram, the second more like a soft systems diagram. The reference in the second is implicit in the text "to reduce the difference between the *desired* and actual mark".

Example 2(a): Diagram



Example 2(b): Diagram



Example 2(a) Explanation

This diagram has the student's desired mark as a reference for the "doing the homework" system. The marking is a sensor measurement. The student calculates the difference between the mark awarded and the desired mark. If the mark is higher than expected, the student spends less time one their homework, if it's lower they spend more time. There's a delay between the submission and marking, shown by two small parallel lines on the arrow. There could be a delay between marking and return, or the decision to spend more time on the next homework and actually doing it. I have not shown these.

[103 words]

Example 2(b) Explanation

The student does their homework and it is marked. If the mark is less than desired the student spends more time on the next homework, otherwise less. This attempt to reduce the difference between the desired mark and the actual mark is shown by a minus sign next to the arrow. There is a delay between submitting the homework and getting it marked, and between getting the mark and deciding to spend more/less time on the homework. Both are shown by small parallel lines on the arrows.

[87 words]

Note, Example 2(a) and 2(b) are two different styles of representing the same negative feedback system. Either style is acceptable as long as the details are all there and discussed adequately, with inclusion of omission of signs justified. The delays are handled differentlt but adequately explained in both cases.

Awarding marks for the explanation.

(i) Award up to [3/10] for a good explanation of the minus signs to show a decrease between the reference and measurement – *e.g.* the mark desired and the mark given.

(ii) Award up to [3/10] for a good explanation of delays and using small parallel lines on arrows. If the student explains why delays are included (or not) give 3 marks. If a delay is incorrect deduct one mark. If no delay or the delays are all wrong give zero marks.

(iii) Award up to [4/10] for how well the example illustrates the concept of negative feedback. It is essential that it is clear what is being reduced at any stage. Again you may disagree with the hypothesised relationship (*e.g.* low marks cause students to try harder) but do not penalise this, unless it is very unrealistic.

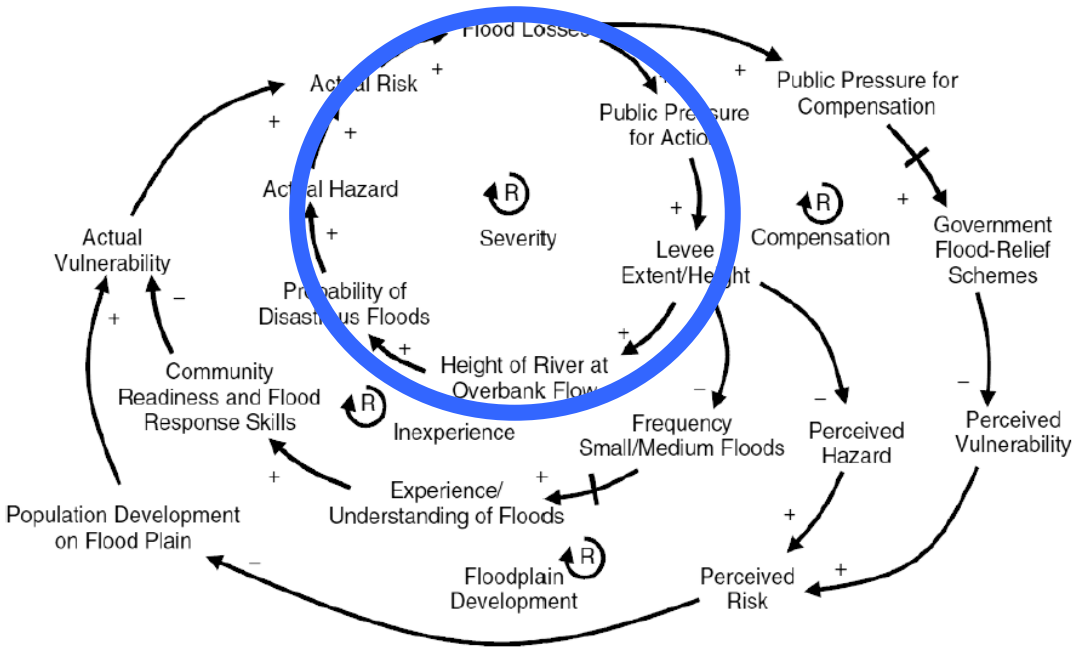
Question 3 **[**Guideline 100 words**]** [20 marks]

(a) In Figure 9 of the Lesson 2 text, give an example of a positive feedback loop associated with Flood Losses.

Marking Guide to Question 3 [Maximum 20 marks]

A simple way to show the most obvious positive feedback cycle is to highlight it somehow, as illustrated below.

Example 3(a)



Another, equally acceptable way, is to list the elements, *e.g.*

Example 3(b)

Flood Losses implies increase of Public Pressure for Action implies increase of Levee Extent/Height implies increase of Height of River at Overbank Flow implies increase of Probability of Disastrous Floods implies increase of Actual Hazard increases implies increase of Actual Risk implies increase of Flood Losses …

[47 words]

(b) Will flood losses increase or decrease in the system? Explain why.

Example 3(c)

At every cycle round the positive feedback loop Flood Losses increase. The only other input to this loop is “actual Vulnerability” which is also positive. Therefore whatever happens in this system, Flood Losses will increase.

[35 words]

Marking the answers

Part (a)

Any way of identifying the positive feedback loop is acceptable. This is the only 'pure' positive feedback loop. Award 10 marks for correctly identifying it.

If the student shows another plausible loop, but which has some negative feedback, give up to 5 marks.

Part (b).

The answer should say that, whatever happens, the risk of Flood Losses increases (5 marks). For full marks they should point out that he only other input to the cycle (Actual Vulnerability) is positive (5 marks).

Question 4

[Guideline 100 words**]** [20 marks]

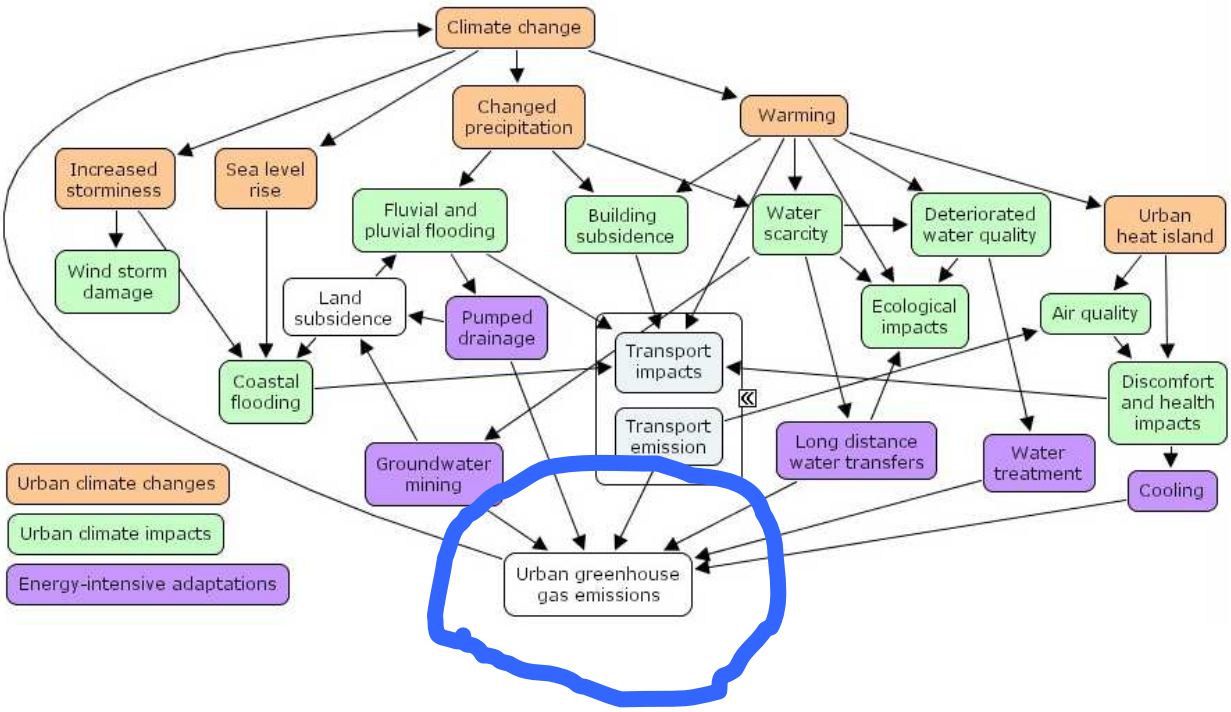
(a) As the cover page of Lesson 2 shows, systems diagrams can get very complicated with very large numbers of arrows. Which of the boxes has the most arrows entering it? This suggests that this box is particularly important in climate change. Do you agree?

(b) When systems diagrams become too complex for a person to understand the feedback loops, is there an alternative?

Marking Guide to Question 4 [Maximum 20 marks]

Part (a)

"Urban greenhouse gas emissions" has 6 arrows entering it which is the most . This can either be shown on a diagram, as below, or in text, as here [5 marks].



The only arrow leading to Climate change comes from Urban greenhouse gas emissions, so in this diagram this box is very important in climate change [4 marks].

However, there are many more inputs to climate change than shown in this diagram, including "natural changes in temperature" and, or course, "non-Urban greenhouse as emissions" such as slash-and-burn rainforest clearance [1 mark].

Marking Part (b) [10 marks]

The text suggests that computer simulation can give insights into the behaviour of very complicated systems [4 marks].

Because of the complexity of the interactions between the loops, computer simulation only allows investigation of *possible* outcomes, and cannot predict definite outcomes [2 marks].

Computer simulations may be sensitive to initial conditions [1 mark].

Simulations must be run many times [3 marks].

Question 5

[Guideline: 1 URLs] [20 marks]

Give a web references (URL) not included in the references that another student might find useful to answer these Question 1, 2 and 3.

Marking Question 5

The URL should define positive and negative feedback loops in systems diagrams [10 marks].

It should explain the use of plus, minus and double line (delay) symbols [6 marks, 2 marks each].

It is hard to find good URLs that would be really helpful, so few URLs are likely to score high marks [award up to 4 marks for 'star quality'].

The URLs must be new. Award zero for either of the references given in the text:

Wasson, R., Integrated Systems: Water, Science at the Shine Dome Canberra, 1{3 May 2002. http://science.org.au/events/sats/sats2002/wasson.html

Zhou, J., 'Learn to Read Causal Loop Diagrams', http://systemsandus.com/2012/08/15/learn-to-read-clds/ (accessed 1st May 2014).