CITM Game Development - Midterm 2 (solution) Examination - Nov 2015

Your Name:

- You have 1 hour and 50 minutes to complete the assignment.
- Be clear and concise on your explanations.
- You can only use the square below to answer each question.
- If you take assumptions, write them down and explain your reasoning.

1. **(3 points)** Adapt the A* algorithm to accept **bidirectional** portals: nodes that teleport the player instantly to another place in the map. Explain the advantages and limitations of your approach if we would have many portals at once. *E. g. Entering "P1 A" would instantly place the player in the other "P1 B" tile and vice versa.*

										Dest.	
Start											
										P1 B	
	P1 A										

Assumptions: Portals have two fixed exits, player cannot choose which portal to exit from. Portals are bidirectional.

We would need to generate one path extra per each portal in the area. Using the example from the exercise, we would generate those paths:

Start -> Dest (length 12)
Start -> P1A -> P1B -> Dest (length 7)
Start -> P1B -> P1A -> Dest (length 27)

The we would order this list and pick the shortest one. We would need to store in the nodes information about a potential portal, including its output gate.

In case of ramping up the portals we would have 1 + 2*amount portals paths to generate. We could optimize trying always the path without portals and rejecting portal paths that are too length in one of its sections early.

This approach would cover cases like destination only reachable via portal.

Other possible answers: thinking of the map like a 3D world / creating a second layer graph of portal connections and then A on it, etc … there are many solutions!*

2. **(2 points)** Write down the step-by-step internal process of a A* algorithm in the map, taking in account that this map contains variable costs for squares: **the highway (H) is three times faster to use compared to other tiles**. Take in account diagonals but you cannot use them to cut walls

*Map Legend: **S**: Start **E**: path end **H**: Highway **W**: Wall*

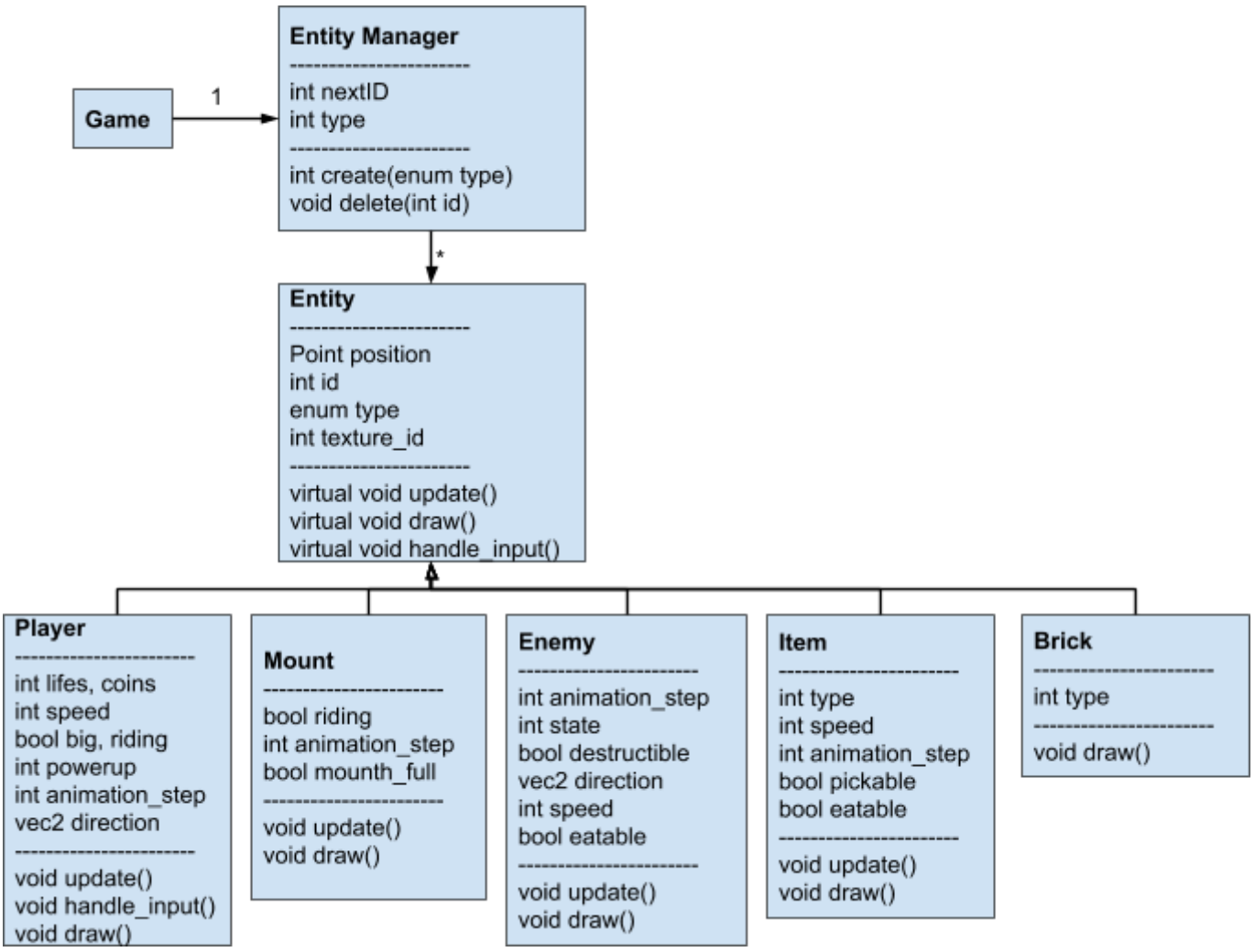
Assumptions: N,S,E,W cost is 10, diagonals is 14. Highway cost is 3 (3.33) and 5 (4.72) for diagonals. We will use clockwise order from north. We use manhattan distance.

				. *(other)* *(42+10)*	. *(other)* *(32+20)*	. closed 22+30	**S**	. 21+50	. 25+60
				E	W	H **closed** 5+20	H closed 8+30	H closed 11+ 40	H 14+50
H	H	H	H	H **closed** 28+10	H **closed** 25+20	. **closed** 22+30	. 42+40	. 21+50	. 25+60

Note that we end up having two tiles with cost 22+30. The first one to evaluate will decide the final path.

3. **(3 points)** Describe your strategy and the UML of each of the classes (including methods and attributes) of an entity manager for Mario World only taking in account what can be seen in this picture. Remember that Yoshi (the green lizard that Mario is riding) likes to eat apples and turtles. If he eats a turtle it can spit it back making an attack.

Check: https://www.youtube.com/watch?v=1FnPe6tinVs from (0:40 to 2:30)



Assumptions: Background is not an entity. We have an enum with all entity types.

4. **(2 points)** If we have a game where the logic runs at 100 frames per second with vsync turned on (monitor refresh rate of 75 Hz) and our main character moves at 150 pixels per second. Taking in account that we have variable time step, how many pixels the character moves every frame ? And if we suddenly drop our logic frame rate to 32 ? **Elaborate** your answer.

Even if our logic frame rate is at 100 FPS, we will go down to 75 FPS with vsync activated due to time wasted in vsync. This means that our average frame will have a time differential of 0.0133 seconds

*Knowing this, in an average frame the main character will move 150 * 0.0133 =* ***~2 pixels per frame***

*If we drop to 32 logic FPS, we would go down to 25 FPS due to vsync, so our dt would be 0.04. That means that our main character will move 150 * 0.04 =* ***6 pixels per frame***