

COMP250: Artificial Intelligence

3: Behaviour trees

Research Journal



Topic assignments

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- ▶ Linked on LearningSpace

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- ▶ I will be checking the wiki in **week 5**, and I hope to see good progress!

Finite state machines



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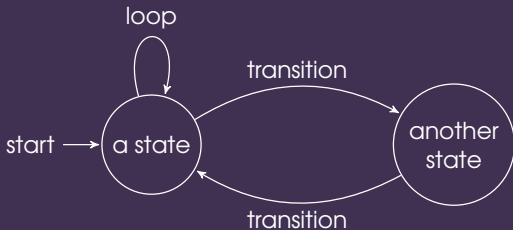
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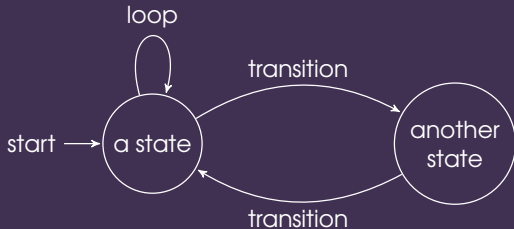
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- ▶ **Inputs** or **events** can cause the FSM to transition to a different state

State transition diagrams



- ▶ FSMs are often drawn as **state transition diagrams**
- ▶ Reminiscent of **flowcharts** and certain types of **UML diagram**

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FSMs for AI behaviour

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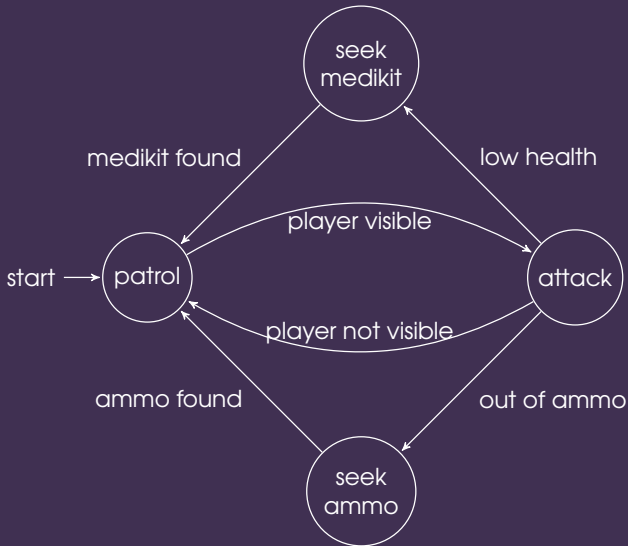
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Beyond FSMs

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- ▶ Hierarchical FSMs
- ▶ Nested FSMs
- ▶ Stack-based FSMs
- ▶ Hierarchical task networks
- ▶ ...

Plus the topic we will be looking at today: **behaviour trees**

Behaviour Trees



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- ▶ First used in Halo 2 (2005), now used extensively
- ▶ Also used in robotics and other non-game AI applications

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- ▶ We will be using the free **Behaviour Machine** library for Unity

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- ▶ “Running” status allows nodes to represent operations that **last multiple frames**

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 - ▶ Control which of the children are executed on each tick

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 - ▶ Returns success for true, failure for false
- ▶ Leaf nodes often have **parameters** to allow for reuse in different situations

Leaf node example

```
using UnityEngine;
using System.Collections;
using BehaviourMachine;

public class GoTo : ActionNode
{
    public GameObjectVar objectToMove;
    public Vector3Var target;
    public FloatVar speed;

    public override Status Update()
    {
        float distance = (objectToMove.Value.transform.position - target.Value).↵
            magnitude;
        float step = speed.Value * Time.deltaTime;
        if (distance < step)
        {
            objectToMove.Value.transform.position = target.Value;
            return Status.Success;
        }
        else
        {
            objectToMove.Value.transform.position = Vector3.MoveTowards(↵
                objectToMove.Value.transform.position, target.Value, step);
            return Status.Running;
        }
    }
}
```

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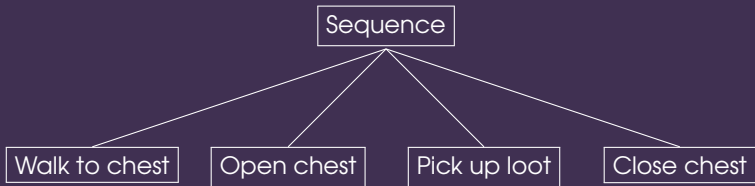
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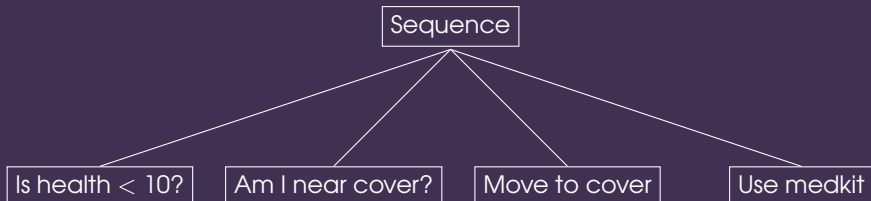
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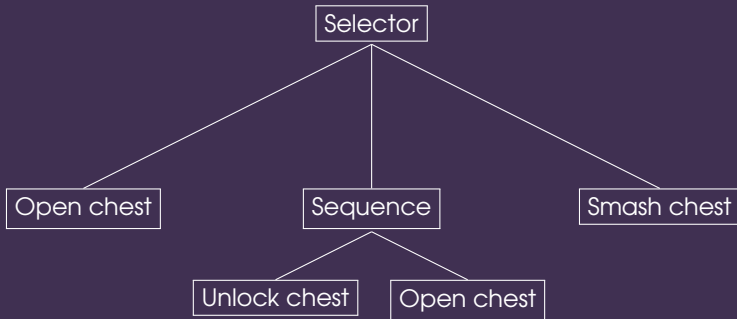
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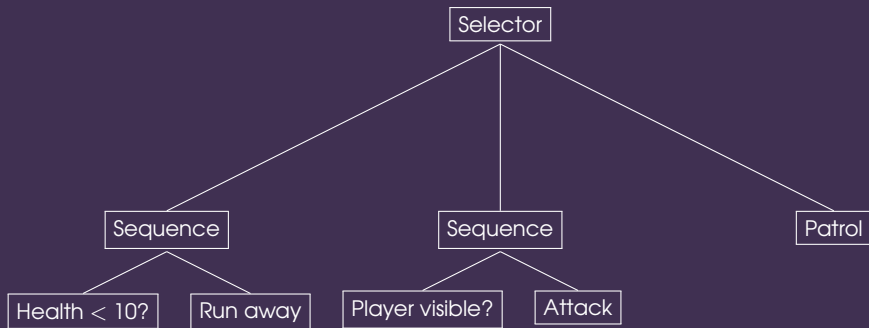
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- ▶ Selector: try a list of alternatives; stop once you find one that works
- ▶ Sequence works like **and**, selector works like **or**

Other composite nodes

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- ▶ Execute children in **random** order

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- ▶ Execute children in **parallel**

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- ▶ Most BT frameworks allow programmers to create custom composite nodes

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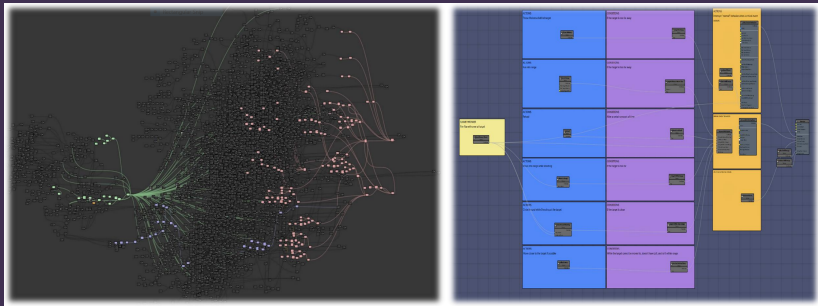
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- ▶ (Shared blackboards mean that your AI has “telepathy” — this may or may not be desirable!)

BTs in The Division



[http://www.gdcvault.com/play/1023382/
AI-Behavior-Editing-and-Debugging](http://www.gdcvault.com/play/1023382/AI-Behavior-Editing-and-Debugging)

Portfolio task proposals

