ANIMATION:

The simulation of movement created by a series of pictures is animation.

Animation is method of photographing successive drawings, models or even puppets to create illusion of movement in a sequence. Because our eyes can only retain an image for approximately 1/ 10 of second, when multiple images appear in fast succession, the brain blends them into a single moving image.

Animation in game programming involves bringing characters, objects, and environments to life by creating the illusion of movement and action. It's a crucial aspect of game development that enhances the player's immersion and engagement. There are various types of animations used in games:

1. Frame by frame
2. Keyframe 2D
3. 3D
4. Stop Motion
5. Animation mixed with live action
6. Motion Graphics
7. White Board
8. Typography
9. Claymation
10. Rotoscope
11. Mechanical
12. Skeletal Animation
13. Morph Target animation (Blend Shapes)
14. Procedural Animation
15. Inverse Kinematics (IK)

1. **Frame by frame**:

   This is also called as traditional animation. This traditional animation technique – sometimes called flipbook animation or the stop-motion method – is like a flipbook come to life. It’s an old-school style of animation, which involves drawing each frame individually with incremental changes in each image adding the sense of motion. **It’s how early animated classics like Steamboat Willie (1928) were created**. While frame by frame gives animators full control over how their characters move and interact with their environment. Most animated videos will run at a minimum of 12 frames per second (FPS).

2. **Keyframe 2D:**

   Keyframe computer animation removes a lot of the time-consuming work associated with stop motion. To put it in the simplest terms, keyframe animation lets you use computers to set the 'key frames' of an element or character's movement – e.g. the beginning, the middle and the end of a movement – and a computer will then render the frames in between those points. This saves huge amounts of time and effort and makes animation a lot more accessible to a much wider range of brands.

3. **3D Animation:**

   3D animation adds a third dimension – depth – to the animation equation, creating a highly dynamic animated environment that empowers marketers to craft realistic settings, characters, objects, textures, and lighting to vitalize their videos in new ways**. Most of the modern animated movies you're likely familiar with use this animation style; "Moana," "Frozen," and "Coco" are just three of thousands of 3D-animated movies created in the past several years.**

4. **Stop Motion Animation:**

   Stop motion is an animation technique through which physical objects are moved in small increments and individually photographed so that, when watched in rapid sequence, they create the feeling of movement.
   Mid-1900s with some animated classics like "Rudolph the Red-Nosed Reindeer" and "Gumby. Modern examples of stop motion include Wes Anderson's latest film, "Isle of Dogs,".

5. **Animation mixed with live action:**

Live-action animated is a film genre that combines live-action filmmaking with animation. Projects that are both live-action and computer-animated tend to have fictional characters or figures represented and characterized by cast members through motion capture and then animated and modeled by animators.

6. **Motion graphics:**

Motion graphics is a type of animated graphic design that usually features a lot of text and simple graphics. While traditional animated videos usually centre around characters and elaborate settings, motion graphics

videos give life to stories that otherwise wouldn't be visual, using shapes, graphics, and text to visually represent the story being told.

7. **Whiteboard animations:**

Whiteboard animation is a type of animation that features the illustrator physically drawing the artwork on a whiteboard or other surface using pens and markers. This animation style became popular shortly after the launch of YouTube in 2005. Even back then, brands were attracted to the way whiteboard animation let viewers see the story come to life before their eyes, and they've kept coming back to this timeless approach ever since.

8. **Typography animation:**

Typography animation has become a popular way to bring life and energy to the screen. It basically refers to the animation of words and data, in time with a voiceover. t tends to be fairly minimalist in style and can be used for anything from corporate presentations to music videos. Typography animation also has its drawbacks. It's usually limited to conveying only a single message and can be visually repetitive, making it difficult to use as a form of extended storytelling.

9. **Clay animation (Claymation):**

Clay animation is a type of stop motion animation that's been around for many decades, but retains a timeless appeal. It has a unique, distinct look that can't be found with other forms of animated video. Clay animation is an incredibly time-consuming process and requires a lot of patience. It can be difficult to create smooth movements, which results in choppiness that detracts from the overall effect.

10. **Rotoscope animation:**

The main strength of frame by rotoscope animation is that it combines the realism of film footage with the expressiveness of hand-drawn animation. The animations can also be incredibly detailed and precise, allowing animators to take advantage of minute changes in movements or expressions. The final product often looks incredibly natural, which can be great for creating truly realistic characters.

The main weakness of frame by rotoscope animation is the cost and time it takes to produce. Animators have to draw each individual frame, which can take a huge amount of time depending on the length and complexity of the

scene. Additionally, due to the complexity of the process, mistakes can be hard to correct and adjustments may have to be made from scratch.

11. Mechanical animation:

Mechanical animation is a type of 3D animation. It involves creating realistic 3D renders of mechanical systems and their components, and it's a great way, essentially, to show how things work.

For example, if you wanted to explain how a car engine worked…It can be done through mechanical animation.

The time involved in creating this kind of video tends to be front-loaded into creating the 3D model itself. Once the model's done, it can be manipulated and moved to reinforce the points you're making in your video.

12. Skeletal Animation:

Description: Involves using a hierarchical structure of bones (skeleton) and skinning (attaching the model to the skeleton) to animate characters.

Usage: Commonly used for character movements and complex animations such as walking, running, and combat.

13. Morph Target Animation (Blend Shapes):

Description: Uses different "morph targets" or shapes to interpolate between various mesh positions. This is often used for facial expressions, lip-syncing, and shape changes.

Usage: Primarily employed for facial animations and shape-shifting effects.

14. Procedural Animation:

Description: Involves generating animation through algorithms or physics simulations rather than relying on pre-made animations.

Usage: Useful for creating natural movements or behaviors, such as cloth simulation, particle effects, or dynamic environment interactions.

15. **Inverse Kinematics (IK):**

Description: Helps in solving the movement of end-effectors based on the desired position, which can be useful for precise control of limb movements.

Usage: Often used for character feet placement on uneven terrains or hand placements in interaction with objects.

Animation Workflow in Game Development:

1.Asset Creation: Artists design and create the 3D models, textures, and rig the characters for animation.

2.Animation Software: Animators use specialized software like Blender, Maya, or 3ds Max to create animations. These animations are then exported to formats compatible with the game engine.

3.Integration with Game Engine: Game developers import the animations into the game engine and implement them using scripts or built-in tools for controlling the playback and blending of animations.

4.Programming & Scripting: Programmers write code to control the playback of animations based on in-game events, player actions, or environmental interactions.

5.Blending and Transition: The game engine allows for smooth transitioning between animations, blending different motions, and controlling the timing of the animations.

Animation is a critical part of game development that contributes to the overall gaming experience, bringing characters and worlds to life and making the gameplay more immersive and engaging for the players.