Theory Assignment 1

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Question 1

$P_c = (11, 2)$
$P_t = (6, 6)$
$V_c = (0, 4)$
time btw update = 0.5s
$V_{max} = 10$
$a_{max} = 24$

a) ① New velocity: $\frac{P_t - P_c}{|P_t - P_c|} V_M = \frac{(6-11, 6-2)}{\sqrt{(6-11)^2 + (6-2)^2}} (10)$

$= \frac{(-5, 4)}{\sqrt{41}} (10) = \left(\frac{-50}{\sqrt{41}}, \frac{40}{\sqrt{41}}\right)$ units/sec

② Since time btw updates is 0.5s,

change of $\left(\frac{-25}{\sqrt{41}}, \frac{20}{\sqrt{41}}\right)$ each update

③ $P'_c = (11, 2) + \left(\frac{-25}{\sqrt{41}}, \frac{20}{\sqrt{41}}\right) = \boxed{(7.0956, 5.1234)}$

④
$P''_c = (3.1913, 8.2469)$
$P'''_c = (7.0956, 5.1234)$
$P^{IV}_c = (3.1913, 8.2469)$
$P^{V}_c = (7.0956, 5.1234)$

b) ① New velocity: $\frac{P_c - P_t}{|P_c - P_t|} v_m = \frac{(11-6,\ 2-6)}{\sqrt{(11-6)^2+(2-6)^2}} (10)$

$= \frac{(5, -4)}{\sqrt{41}} (10) = \left(\frac{50}{\sqrt{41}}, \frac{-40}{\sqrt{41}}\right)$ units/sec

② Since time btw updates is 0.5 s,

change of $\left(\frac{25}{\sqrt{41}}, \frac{-20}{\sqrt{41}}\right)$ each update

③ $P'_c = (11, 2) + \left(\frac{25}{\sqrt{41}}, \frac{-20}{\sqrt{41}}\right) = (14.9043, -1.1234)$

④
$P''_c = (18.8086, -4.2469)$

$P'''_c = (22.7130, -7.3704)$

$P^{IV}_c = (26.6173, -10.4939)$

$P^{V}_c = (30.5217, -13.6173)$

c) ① New Acceleration: $\left(\frac{P_T - P_c}{|P_T - P_c|}\right) a_m = \frac{(6-11, 6-2)}{\sqrt{(6-11)^2 + (6-2)^2}} (24)$

$= \frac{(-5, 4)}{\sqrt{41}} (24) = \left(\frac{-120}{\sqrt{41}}, \frac{96}{\sqrt{41}}\right)$

② New Velocity: $V = V_c + a t = (0, 4) + \left(\frac{-120}{\sqrt{41}}, \frac{96}{\sqrt{41}}\right)\left(\frac{1}{2}\right)$

$= (-9.3704, 11.4963)$

③ Check velocity $|v| \leq 10 \rightarrow 14.83 \leq 10$

↳ false so need to clamp the velocity

$\frac{(-9.3704, 11.4963)}{14.83} \times 10 = (-6.318, 7.751)$

④ $P'_c = P_c + vt = (11, 2) + (-6.318, 7.751)\left(\frac{1}{2}\right)$

$= (7.841, 5.875)$

⑤
$P''_c = (3.312, 7.995)$
$P'''_c = (3.602, 6.538)$
$P^{IV}_c = (8.160, 4.483)$
$P^{V}_c = (7.808, 5.877)$

d) For kinematic seek, the AI character goes straight towards the target with the constant max speed. If it overshoots, it turns around instantly.

For steering seek, the AI character's velocity is changed by accelaration towards the target causing the path to be a spiral towards the target.

Question 2

a) ① $P_c = \left(\frac{21+5+28}{3}, \frac{16+11+9}{3}\right) = (18, 12)$

② $V_c = \left(\frac{3+3+6}{3}, \frac{1+3+5}{3}\right) = (4, 3)$

③ $P_{anchor} = P_c + k_{offset} V_c = (18, 12) + (1)(4, 3)$

$= (22, 15)$

b) ① $\Delta P_{s1} = (22 - 18, 18 - 12) = (4, 6)$

$\Delta P_{s2} = (6 - 18, 13 - 12) = (-12, 1)$

$\Delta P_{s3} = (29 - 18, 12 - 12) = (11, 0)$

② $P_{s1} = (22 + 4, 15 + 6) = (26, 21)$

$P_{s2} = (22 + (-12), 15 + 1) = (10, 16)$

$P_{s3} = (22 + (11), 15 + 0) = (33, 15)$

c) When a character is killed off the center of mass changes (P_c) but the anchor point remains the same even if the occupied slots change.