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Grade	**16.00** out of 16.00 (**100**%)

Question **1**

Correct

Mark 8.00 out of 8.00

Consider a clipping window defined with vertices A(25, 30), B(75, 30), C(75, 80) and D(25, 80). Let P_1P_2 be a line from (5, 20) to (55, 90) to be clipped against the clipping window. Write the answers of following questions. [All calculation should be done with 3 decimal places (round off)]

a) [4Marks] Fill the following table using Liang-Barsky line clipping algorithm. [Notation are used as per lecture]

i	$Edge$	p_i	q_i	t_i
1	DA	-50	-20	0.4
2	CB	50	70	1.4
3	AB	-70	-10	0.143
4	DC	70	60	0.857

b) [2 marks] Write the t_{min} and t_{max} values.

t_{min} = 0.4 and t_{max} = 0.857

c) [2 marks] Write the coordinate values at t_{min} and t_{max}

At t_{min}: x = 25 and y = 48

At t_{max}: x = 47.857 and y = 80

Your answer is correct.

Answer with detailed calculations:

For Edge DA

p1 = - (55 - 5) = -50;   q1 = (5 - 25) = -20 ;   t1 = round(q1/p1, 3) = 0.4;

For Edge CB

p2 = (55 - 5) = 50;   q2 = (75 - 5) = 70;   t2 = round(q2/p2, 3) = 1.4;

For Edge AB

p3 = -(90 - 20) = -70;   q3 = (20 - 30) = -10;   t3 = round(q3/p3, 3) = 0.143;

For Edge DC

p4 = (90 - 20) =70;   q4 = (80 - 20) = 60 ;   t4 = round(q4/p4, 3) = 0.857;

t_min = max(0, t1, t3) = max(0, 0.4, 0.143) = 0.4;

t_max = min(1, t2, t4) = min(1, 1.4, 0.857) = 0.857;

At t_min:

x(0.4) = round(5 + (55 - 5)*0.4, 3) = 25;

y(0.4) = round(20 + (90 - 20)*0.4, 3) = 48;

At t_max:

x(0.857) = round(5 + (55 - 5)*0.857, 3) = 47.85;

y(0.857) = round(20 + (90 - 20)*0.857, 3) = 79.99;

Question **2**

Correct

Mark 8.00 out of 8.00

Consider a clipping window defined with vertices A(50, 90), B(70, 110), C(60, 120) and D(40, 80). Let P_1P_2 be a line from (25, 105) to (85, 105) to be clipped against the clipping window. Write the answers of following questions.

[All calculation should be done with 3 decimal places (round off)]

a) [4Marks] Fill the following information for Cyrus-Beck line clipping algorithm. Consider outward normal vector for each edge ie. direction of normal is towards outside. [Notation are used as per lecture]

$Edge(E_i)$	$Normal(N_i)$	P_{Ei}	t	PE/PL
DA	(+i , -j)	A	0.667	PL

✔

CB	(+i , +j)	C	0.833	PL

✔

AB	(+i , -j)	A	0.667	PL

✔

DC	(-i , +j)	C	0.458	PE

✔

Detailed Answer:

Clipping Window : $A(50,90)B(70,110)C(60,120)D(40,80)$

Line to be clipped : $P1(25,105)P2(85,105)$

$D = (P_1 - P_2) = (60,0)$

#For DA edge

$N_{DA} = (1,-1)$

Direction Symbol $N_{DA} = (+i,-j)$

$PE_{DA} = (50,90)$

$P_1 - PE_{DA} = (-25,15)$

$N_{DA} \cdot (P_1 - PE_{DA}) = -40$

$(N_{DA} \cdot D) = 60$

$t_{DA} = -\frac{N_{DA}\cdot(P_1 - PE_{DA})}{(N_{DA}\cdot D)} = round(-\frac{-40}{60},3) = 0.667$

$PE/PL = PL$

#For CB edge

$N_{CB} = (1,1)$

Direction Symbol $N_{CB} = (+i,+j)$

$PE_{CB} = (60,120)$

$P_1 - PE_{CB} = (-35,-15)$

$N_{CB} \cdot (P_1 - PE_{CB}) = -50$

$(N_{CB} \cdot D) = 60$

$t_{CB} = -\frac{N_{CB}\cdot(P_1 - PE_{CB})}{(N_{CB}\cdot D)} = round(-\frac{-50}{60},3) = 0.833$

$PE/PL = PL$

#For AB edge

$N_{AB} = (1,-1)$

Direction Symbol $N_{AB} = (+i,-j)$

$PE_{AB} = (50,90)$

$P_1 - PE_{AB} = (-25,15)$

$N_{AB} \cdot (P_1 - PE_{AB}) = -40$

$(N_{AB} \cdot D) = 60$

$t_{AB} = -\frac{N_{AB}\cdot(P_1 - PE_{AB})}{(N_{AB}\cdot D)} = round(-\frac{-40}{60},3) = 0.667$

$PE/PL = PL$

#For DC edge

$N_{DC} = (-2,1)$

Direction Symbol $N_{DC} = (-i,+j)$

$PE_{DC} = (60,120)$

$P_1 - PE_{DC} = (-35, -15)$
$N_{DC} \cdot (P_1 - PE_{DC}) = 55$
$(N_{DC} \cdot D) = -120$
$t_{DC} = -\frac{N_{DC} \cdot (P_1 - PE_{DC})}{(N_{DC} \cdot D)} = round(-\frac{55}{-120}, 3) = 0.458$
$PE/PL = PE$

b) [2 marks] Write the t_{min} and t_{max} values.

t_{min} = 0.458 and t_{max} = 0.667

✔

Detailed Answer:

$t_{min} = max(0, t_{DC}) = max(0, 0.458) = 0.458$ #PE
$t_{max} = min(1, t_{DA}, t_{CB}, t_{AB}) = min(1, 0.667, 0.833, 0.667) = 0.667$ #PL

c) [2 mark] Write the coordinate values at t_{min} and t_{max}

At t_{min}: x = 52.5 and y = 105

✔

Detailed Answer:

Line Eqn:
$P(t) = P_1 + (P_2 - P_1) * t$
At t_{min}
$x(0.458) = round(25 + (85 - 25) * 0.458, 3) = 52.48;$
$y(0.458) = round(105 + (105 - 105) * 0.458, 3) = 105;$

At t_{max}: x = 65 and y = 105

✔

Detailed Answer:

Line Eqn:
$P(t) = P_1 + (P_2 - P_1) * t$
At t_{max}
$x(0.667) = round(25 + (85 - 25) * 0.667, 3) = 65.02;$
$y(0.667) = round(105 + (105 - 105) * 0.667, 3) = 105;$