Step-1

Let three states T, C and A produces a million barrels of oil. In a state CH 8,000,000 barrels are needed from three producers at a distance of 1,000 miles, 2,000 and 3,000 miles respectively. In another state NE 2,200,000 barrels are needed from those three producers only at a distance of 1,500 miles, 3,000 miles and 3,700 miles. If shipments cost one unit for each barrel mile, to find what linear program will minimize the shipping cost.

Step-2

Consider the following notations:

For state CH following notations are considered:

$x = 1,000 \text{ miles}$
$y = 2,000 \text{ miles}$
$z = 3,000 \text{ miles}$

For state NE following notations are considered:

$u = 1,500 \text{ miles}$
$v = 3,000 \text{ miles}$
$w = 3,700 \text{ miles}$

Step-3

Shipment cost is given as one unit for each barrel. So, total cost for state CH and NE will be as follows:

$1,000x + 2,000y + 3,000z + 1,500u + 3,000v + 3,700w$

As per the condition state CH needs 8,000,000 barrels from three producers at a distance of 1,000 miles, 2,000 and 3,000 miles respectively. So, the constraint will be:

$x + y + z = 8,000,000$

Step-4

Another condition state NE needs 2,200,000 barrels from all the three producers at a distance of 1,500 miles, 3,000 miles and 3,700 miles respectively. So, the constraint will be:

$u + v + w = 2,200,000$

Step-5

Total barrels of oil required by both the states are:

$2,200,000 + 800,000 = 3,000,000$

Now each state can produce total of one million barrel. So following can be said:

$$x+u=1,000,000$$
$$y+v=1,000,000$$
$$z+w=1,000,000$$

Step-6

Therefore, linear program can be stated as follows:

Minimize cost: $1,000x+2,000y+3,000z+1,500u+3,000v+3,700w$

Subject to:

$$x+y+z=8,000,000$$
$$u+v+w=2,200,000$$

$$x+u=1,000,000$$
$$y+v=1,000,000$$
$$z+w=1,000,000$$

$$\boxed{x,y,z,u,v,w\geq 0}$$