

Program 4

Consider S and T as variables and the following relation representing the relationships:

- a: $\neg(S \vee T)$
- b: $(S \wedge T)$
- c: $T \vee \neg T$
- d: $\neg(S \leftrightarrow S)$
- e: $\neg S \wedge \neg T$

Analyse the following for PL-TT entailment and show whether

- (i). 'a' entails 'b',
- (ii). 'a' entails 'c',
- (iii). 'a' entails 'd' and
- (iv). 'a' entails 'e'

```
N = 4
def main():

    s = [1,0,1,0]
    t = [1,1,0,0]
    a=[]
    b=[]
    c=[]
    d=[]
    e=[]

    for i in range(N):
        a.append(not(s[i] or t[i]))
        b.append(bool(s[i] and t[i]))
        c.append(bool(t[i] or(not(t[i]))))
        d.append(not(bidir(s[i],s[i])))
        e.append(imp((not(s[i])),(not(t[i]))))

    print("Truth table of a: ",a)
    print("Truth table of b: ", b)
    print("Truth table of c: ", c)
    print("Truth table of d: ", d)
    print("Truth table of e: ", e)

    p=entails(a, b)
    q=entails(a,c)
    r=entails(a, d)
    s=entails(a, e)
    print("a entails b: ",p)
    print("a entails c: ", q)
    print("a entails d: ", r)
    print("a entails e: ", s)

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def imp(j,k):
    return (not(j)) or k

def bidir(j,k):
    return (imp(j,k) and imp(k,j))

def entails(m,n):
    #for i in j:
    for i in range(N):
        for j in range(N):
            if (m[i] and n[j]== 1):
                if(i==j):
                    return "yes"
                    break

    return "NO"

if __name__ == '__main__':
    main()
```

Output:

```
Truth table of a: [False, False, False, True]
Truth table of b: [True, False, False, False]
Truth table of c: [True, True, True, True]
Truth table of d: [False, False, False, False]
Truth table of e: [True, False, True, True]
a entails b: NO
a entails c: yes
a entails d: NO
a entails e: yes
```