# Listy

```
k=[]
print(type(k))
```

```
k=[2]
print(type(k))
```

```
k=[2,]
print(type(k))
```

# Listy

```
k=[]
print(type(k))
```

```
k=[2]
print(type(k))
```

```
k=[2,]
print(type(k))
```

```
k=[1,2.3,'3',(4,7),[2,3,4],]
print(len(k))
```

# Listy

```
k=[]
print(type(k))
```

```
k=[2]
print(type(k))
```

```
k=[2,]
print(type(k))
```

```
k=[1,2.3,'3',(4,7),[2,3,4],]
print(len(k))
```

```
print(k[0], k[len(k)-1], k[-1])
```

# Listy

```
k=[]
print(type(k))
```

```
k=[2]
print(type(k))
```

```
k=[2,]
print(type(k))
```

```
k=[1,2.3,'3',(4,7),[2,3,4],]
print(len(k))
```

```
print(k[0], k[len(k)-1], k[-1])
```

```
#k[-2][1]='a'
k[-2]='a'
```

# Uwaga

```
bool(0), bool(1)          #(False, True)

bool([]), bool([1])       #(False, True)

bool(''), bool('a')       #(False, True)

a,b=1,None
bool(a), bool(b)          #(True, False)
```

# Wycinki list

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
```

# Wycinki list

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

print(k[:])
```

# Wycinki list

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

print(k[:])

print(k[2:-3])
```

# Wycinki list

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

print(k[:])

print(k[2:-3])

print(k[2:-3:2])
```

# Wycinki list

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
print(k[:])
print(k[2:-3])
print(k[2:-3:2])
print(k[2:])
```

# Wycinki list

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
print(k[:])
print(k[2:-3])
print(k[2:-3:2])
print(k[2:])
print(k[:-3])
```

# Wycinki list

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
print(k[:])
print(k[2:-3])
print(k[2:-3:2])
print(k[2:])
print(k[:-3])
print(k[::-1])
```

# Kopiowanie list

```
k=[1,2.3,'3',(4,7),[2,3,4],]

c=k
c[1]=[7,8,9]
print(c,k)
print(id(c),id(k))
```

# Kopiowanie list

```
k=[1,2.3,'3',(4,7),[2,3,4],]

c=k
c[1]=[7,8,9]
print(c,k)
print(id(c),id(k))


c=k[:]
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))
```

# Kopiowanie list

```
k=[1,2.3,'3',(4,7),[2,3,4],]

c=k
c[1]=[7,8,9]
print(c,k)
print(id(c),id(k))


c=k[:]
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))

c[-1][1]='7,8,9'
print(c,k)
```

# Kopiowanie list

```
k=[1,2.3,'3',(4,7),[2,3,4],]

c=k
c[1]=[7,8,9]
print(c,k)
print(id(c),id(k))


c=k[:]
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))

c[-1][1]='7,8,9'
print(c,k)


c=k.copy()
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))
```

# Kopiowanie list

```
k=[1,2.3,'3',(4,7),[2,3,4],]

c=k
c[1]=[7,8,9]
print(c,k)
print(id(c),id(k))


c=k[:]
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))

c[-1][1]='7,8,9'
print(c,k)


c=k.copy()
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))

c[-1][1]='7,8,9'
print(c,k)
```

# Kopiowanie list

```
import copy

k=[1,2.3,'3',(4,7),[2,3,4],]

c=copy.copy(k)
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))
```

# Kopiowanie list

```
import copy

k=[1,2.3,'3',(4,7),[2,3,4],]

c=copy.copy(k)
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))


c[-1][1]='7,8,9'
print(c,k)
```

# Kopiowanie list

```
import copy

k=[1,2.3,'3',(4,7),[2,3,4],]

c=copy.copy(k)
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))


c[-1][1]='7,8,9'
print(c,k)


c=copy.deepcopy(k)
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))
```

# Kopiowanie list

```
import copy

k=[1,2.3,'3',(4,7),[2,3,4],]

c=copy.copy(k)
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))


c[-1][1]='7,8,9'
print(c,k)


c=copy.deepcopy(k)
c[1]='7,8,9'
print(c,k)
print(id(c),id(k))


c[-1][1]='7,8,9'
print(c,k)
```

# Zliczanie/znajdowanie elementu w liście

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

print(k.count(13))
print(k.count(-13))
```

# Zliczanie/znajdowanie elementu w liście

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

print(k.count(13))
print(k.count(-13))


print(k.index(13))
#print(k.index(-13))
```

# Zliczanie/znajdowanie elementu w liście

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

print(k.count(13))
print(k.count(-13))


print(k.index(13))
#print(k.index(-13))



print(13 in k)
print(13 not in k)
```

# Zliczanie/znajdowanie elementu w liście

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

print(k.count(13))
print(k.count(-13))


print(k.index(13))
#print(k.index(-13))



print(13 in k)
print(13 not in k)


if 13 in k:
 pass

if 13 not in k:
 pass
```

# Wstawianie elementu do listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

k.insert(4,-13)
print(k)
```

# Wstawianie elementu do listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

k.insert(4,-13)
print(k)

k.insert(-23,4)
k.insert(23,4)
print(k)
```

# Wstawianie elementu do listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

k.insert(4,-13)
print(k)

k.insert(-23,4)
k.insert(23,4)
print(k)


k[1:4]=[7,8,9,10,]          #(7,8,9,10,), '78'
print(k)

k[1:4]=[[7,8,],]
print(k)
```

# Usuwanie elementu/ów listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]


k.remove(1)                    #k.remove(-4)
print(k)
```

# Usuwanie elementu/ów listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]


k.remove(1)                    #k.remove(-4)
print(k)


del k[3]                       #del k[-23]
print(k)
```

# Usuwanie elementu/ów listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]


k.remove(1)                    #k.remove(-4)
print(k)


del k[3]                       #del k[-23]
print(k)

del k[-3:]
print(k)
```

# Usuwanie elementu/ów listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]


k.remove(1)                    #k.remove(-4)
print(k)


del k[3]                       #del k[-23]
print(k)

del k[-3:]
print(k)


print(k.pop())
print(k)

print(k.pop(-3))               #print(k.pop(-23))
print(k)
```

# Usuwanie elementu/ów listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]


k.remove(1)                    #k.remove(-4)
print(k)


del k[3]                       #del k[-23]
print(k)

del k[-3:]
print(k)


print(k.pop())
print(k)

print(k.pop(-3))               #print(k.pop(-23))
print(k)


k.clear()
print(k)
```

# Rozbudowywanie listy

```
k=[1]*10
k[3]+=1
```

# Rozbudowywanie listy

```
k=[1]*10
k[3]+=1
```

```
k=[[]]*10
k[3].append(1)
```

# Rozbudowywanie listy

```
k=[1]*10
k[3]+=1
```

```
k=[[]]*10
k[3].append(1)
```

```
k=[[] for i in range(10)]
k[3].append(1)
```

# Rozbudowywanie listy

```
k=[1]*10
k[3]+=1
```

```
k=[[]]*10
k[3].append(1)
```

```
k=[[] for i in range(10)]
k[3].append(1)
```

```
k[3].append([1,2,3])
print(k)
k[3].extend([1,2,3])
print(k)
```

# Rozbudowywanie listy

```
k=[1]*10
k[3]+=1
```

```
k=[[]]*10
k[3].append(1)
```

```
k=[[] for i in range(10)]
k[3].append(1)
```

```
k[3].append([1,2,3])
print(k)
k[3].extend([1,2,3])
print(k)
```

```
k[3].append('1,2,3')
print(k)
k[3].extend('1,2,3')
print(k)
```

# Range

```
k=[]
for i in range(10):
    k.append(i)
```

# Range

```
k=[]
for i in range(10):
    k.append(i)
```

```
k=list(range(10))
```

# Range

```
k=[]
for i in range(10):
    k.append(i)
```

```
k=list(range(10))
```

```
k=list(range(3,10))
```

# Range

```
k=[]
for i in range(10):
  k.append(i)
```

```
k=list(range(10))
```

```
k=list(range(3,10))
```

```
k=list(range(3,10,2))
```

# Range

```
k=[]
for i in range(10):
  k.append(i)
```

```
k=list(range(10))
```

```
k=list(range(3,10))
```

```
k=list(range(3,10,2))
```

```
k=list(range(10,0,-1))
```

# Range

```
k=[]
for i in range(10):
  k.append(i)
```

```
k=list(range(10))
```

```
k=list(range(3,10))
```

```
k=list(range(3,10,2))
```

```
k=list(range(10,0,-1))
```

```
k=[i for i in range(10)]
```

# Pętla

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
for i in k:
    i*=2
    print(i, end=', ')

print('\n',k)
```

# Pętla

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
for i in k:
    i*=2
    print(i, end=', ')

print('\n',k)


for i in range(len(k)):
    k[i]*=2
```

# Pętla

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
for i in k:
    i*=2
    print(i, end=', ')

print('\n',k)


for i in range(len(k)):
    k[i]*=2


for i,v in enumerate(k):
    k[i]=1 if v>0 else -1
```

# Pętla

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
for i in k:
    i*=2
    print(i, end=', ')

print('\n',k)


for i in range(len(k)):
    k[i]*=2


for i,v in enumerate(k):
    k[i]=1 if v>0 else -1


for i in k:
    if i%2:          #if not i%2:
        break
else:
    print('kiedy?')
```

# Lista składana

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

np=[i for i in k if i%2]

np=[1 if i>0 else -1 for i in k]
```

# Lista składana

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

np=[i for i in k if i%2]

np=[1 if i>0 else -1 for i in k]
```

```
k=[(k[i],k[-i-1]) for i in range(len(k)//2)]
print(k)
```

# Lista składana

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]

np=[i for i in k if i%2]

np=[1 if i>0 else -1 for i in k]
```

```
k=[(k[i],k[-i-1]) for i in range(len(k)//2)]
print(k)
```

```
for i,j in k:
  print(i,j)
```

# Pętla zagnieżdżona/lista składana

```
N=3
k=[]
for i in range(N):
    tmp=[]
    for j in range(N):
        tmp.append((i,j))
    k.append(tmp)
```

# Pętla zagnieżdżona/lista składana

```
N=3
k=[]
for i in range(N):
  tmp=[]
  for j in range(N):
    tmp.append((i,j))
  k.append(tmp)
```

```
k,tmp=[],[]
for i in range(N):
  for j in range(N):
    tmp.append((i,j))
  k.append(tmp)
  tmp.clear()
```

# Pętla zagnieżdżona/lista składana

```
N=3
k=[]
for i in range(N):
  tmp=[]
  for j in range(N):
    tmp.append((i,j))
  k.append(tmp)
```

```
k,tmp=[],[]
for i in range(N):
  for j in range(N):
    tmp.append((i,j))
  k.append(tmp)
  tmp.clear()
```

# Pętla zagnieżdżona/lista składana

```
N=3
k=[]
for i in range(N):
  tmp=[]
  for j in range(N):
    tmp.append((i,j))
  k.append(tmp)
```

```
k,tmp=[],[]
for i in range(N):
  for j in range(N):
    tmp.append((i,j))
  k.append(tmp)
  tmp.clear()
```

```
k=[[(i,j) for j in range(N)] for i in range(N)]
```

# Sortowanie

```
k=[(89, 34), (92, 31), (96, 0), (48, 30), (38, 10),]

c=k[:]
c.sort()          #c=c.sort()
print(c)
```

# Sortowanie

```
k=[(89, 34), (92, 31), (96, 0), (48, 30), (38, 10),]

c=k[:]
c.sort()          #c=c.sort()
print(c)


c=k[:]
c.sort(key=lambda x: x[1])
print(c)
```

# Sortowanie

```
k=[(89, 34), (92, 31), (96, 0), (48, 30), (38, 10),]

c=k[:]
c.sort()          #c=c.sort()
print(c)


c=k[:]
c.sort(key=lambda x: x[1])
print(c)


c=k[:]
c.sort(reverse=True)
print(c)
```

# Sortowanie

```
k=[(89, 34), (92, 31), (96, 0), (48, 30), (38, 10),]

c=k[:]
c.sort()          #c=c.sort()
print(c)


c=k[:]
c.sort(key=lambda x: x[1])
print(c)


c=k[:]
c.sort(reverse=True)
print(c)


c=k[:]
for i,j in sorted(k):              #for i in sorted(k):
  print(i,j)                       #  print(i[0],i[1])
print(c)
```

# Odwrócenie listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
```

```
c=k[:]
c.sort(reverse=True)
print(c)
```

# Odwrócenie listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
```

```
c=k[:]
c.sort(reverse=True)
print(c)
```

```
c=k[:]
c.reverse()
print(c)
```

# Odwrócenie listy

```
k=[8, 0, 17, 1, 10, 13, 19, 13, 10, 3,]
```

```
c=k[:]
c.sort(reverse=True)
print(c)
```

```
c=k[:]
c.reverse()
print(c)
```

```
c=k[::-1]
print(c)
```