In [1]:

```
import numpy as np
import matplotlib.pyplot as plt
```

Using accept-reject

In [2]:

```
dls = [2, 5, 10, 11, 12, 13, 14, 15]
npts = [100, 1000, 10000]
NPOINTS = 100
```

In [3]:

```
total_iter = np.zeros(len(dls))
```

In [4]:

```
for idx, d in enumerate(dls):
    count = 0
    while count != NPOINTS:
        x = np.random.uniform(low = -1.0, high = 1.0, size = d)
        if np.linalg.norm(x) < 1:
            count = count +1
        total_iter[idx] += 1
    print("Points generated for d = ", d)
```

```
Points generated for d =  2
Points generated for d =  5
Points generated for d =  10
Points generated for d =  11
Points generated for d =  12
Points generated for d =  13
Points generated for d =  14
Points generated for d =  15
```

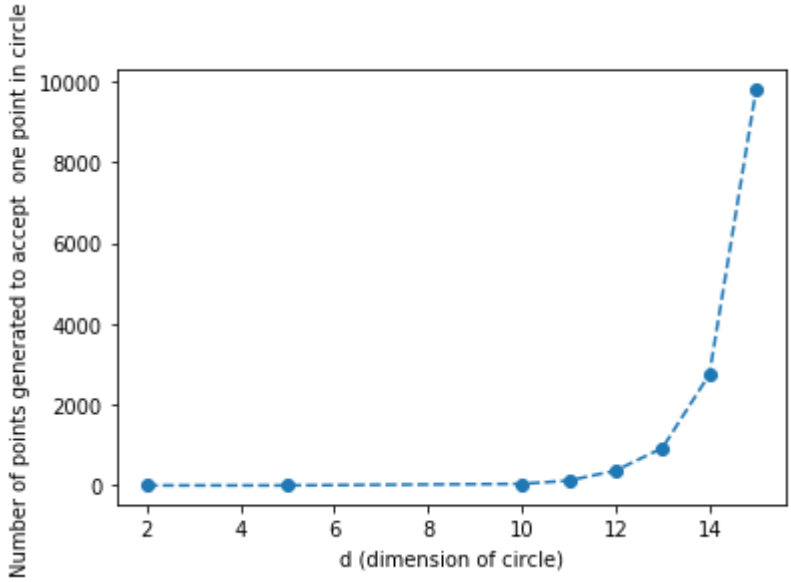
In [35]:

```
x = total_iter/NPOINTS
for i, d in zip(x, dls):
    print (d, ' & ',i )
```

```
2  &  1.4
5  &  7.54
10  &  384.1
11  &  1189.32
12  &  3662.61
13  &  9276.96
14  &  27464.29
15  &  98154.31
```

In [32]:

```
plt.plot(dls, total_iter/(10*NPOINTS), 'o--')
plt.xlabel('d (dimension of circle)')
plt.ylabel('Number of points generated to accept  one point in circle')
plt.savefig('Image-Q3/acept-reject.png')
```



MCMC

In [75]:

```
dls = [2, 5, 10, 15, 20, 25, 30, 35, 40, 45,  50]
npts = [100, 1000, 10000]
NPOINTS = 100
```

In [37]:

```

```

In [38]:

```
def identity(x):
    if np.linalg.norm(x) < 1:
        return 1
    else:
        return 0
```

In [46]:

```
def compute_alpha(w, x):
    if identity(w) == 0:
        return 0
    else:
        return 1
```

In [49]:

```
def generate_w(xold, d):
    w = np.zeros(d)
    for idx in range(d):
        w[idx] = np.random.uniform(low = xold[idx] - 0.2, high = xold[idx] + 0.2, s
    return w
```

In [71]:

```
total_iter = np.zeros(len(dls))
for idx, d in enumerate(dls):
    count = 0
    xold = np.zeros(d)
    while count != NPOINTS:
        w = generate_w(xold, d)
        alpha = compute_alpha(w, x)
        u = np.random.uniform(size = 1)
        if u < alpha:
            xold = w
            count = count +1
        total_iter[idx] += 1
    print("Points generated for d = ", d)
```

```
Points generated for d =  2
Points generated for d =  5
Points generated for d =  10
Points generated for d =  15
Points generated for d =  20
Points generated for d =  25
Points generated for d =  30
Points generated for d =  35
Points generated for d =  40
Points generated for d =  45
Points generated for d =  50
```

In [77]:

```
x = total_iter/NPOINTS
for i, d in zip(x, dls):
    print (d, ' & ',i )
```

```
2  &  1.14
5  &  1.28
10  &  1.72
15  &  2.76
20  &  3.89
25  &  6.85
30  &  15.45
35  &  26.72
40  &  54.77
45  &  107.71
50  &  363.42
```

In [76]:

```
plt.plot(dls, total_iter/(NPOINTS), 'o--')
plt.xlabel('d (dimension of circle)')
plt.ylabel('Number of points generated to accept  one point in circle')
plt.savefig('Image-Q3/mcmc.png')
```