作业 1

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1. ping 另外一台计算机：

```
[yiner@yinerMacBookPro] desktop $ ping 10.132.127.254
PING 10.132.127.254 (10.132.127.254): 56 data bytes
64 bytes from 10.132.127.254: icmp_seq=0 ttl=64 time=1.049 ms
64 bytes from 10.132.127.254: icmp_seq=1 ttl=64 time=1.182 ms
64 bytes from 10.132.127.254: icmp_seq=2 ttl=64 time=1.078 ms
64 bytes from 10.132.127.254: icmp_seq=3 ttl=64 time=0.743 ms
64 bytes from 10.132.127.254: icmp_seq=4 ttl=64 time=0.575 ms
64 bytes from 10.132.127.254: icmp_seq=5 ttl=64 time=0.662 ms
64 bytes from 10.132.127.254: icmp_seq=6 ttl=64 time=0.778 ms
64 bytes from 10.132.127.254: icmp_seq=7 ttl=64 time=0.982 ms
64 bytes from 10.132.127.254: icmp_seq=8 ttl=64 time=3.301 ms
64 bytes from 10.132.127.254: icmp_seq=9 ttl=64 time=0.660 ms
64 bytes from 10.132.127.254: icmp_seq=10 ttl=64 time=0.758 ms
64 bytes from 10.132.127.254: icmp_seq=11 ttl=64 time=13.114 ms
^C
--- 10.132.127.254 ping statistics ---
12 packets transmitted, 12 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 0.575/2.074/13.114/3.401 ms
```

2. tracert 一个服务器（Mac 上命令是 traceroute）：

```
[yiner@yinerMacBookPro] desktop $ traceroute www.cmu.edu
traceroute to www-cmu-prod-vip.andrew.cmu.edu (128.2.42.52), 64 hops max, 52 byte packets
 1  * * *
 2  172.20.255.250 (172.20.255.250)  0.501 ms  0.434 ms  0.594 ms
 3  58.48.72.1 (58.48.72.1)  1.241 ms  1.060 ms  0.919 ms
 4  * * *
 5  * * *
 6  * * *
 7  202.97.94.138 (202.97.94.138)  18.226 ms  18.151 ms  18.121 ms
 8  * 202.97.94.114 (202.97.94.114)  19.379 ms *
 9  * * *
10  * * *
11  xe-5-0-1.0.rtsw.wilc.net.internet2.edu (162.252.69.138)  177.711 ms  191.297 ms  181.660 ms
12  * * *
13  * * *
14  lo-0.8.rtsw.phil.net.internet2.edu (64.57.20.138)  240.269 ms  243.468 ms  253.675 ms
15  204.238.76.234 (204.238.76.234)  249.308 ms  248.335 ms  248.574 ms
16  204.238.76.50 (204.238.76.50)  245.062 ms  242.084 ms  246.051 ms
17  * 100.121.0.41 (100.121.0.41)  253.456 ms  277.441 ms
18  core0-pod-i-cyh.gw.cmu.net (128.2.0.249)  250.095 ms  253.264 ms *
19  pod-d-dcns-core0.gw.cmu.net (128.2.0.210)  255.339 ms  255.378 ms  257.231 ms
20  www-cmu-prod-vip.andrew.cmu.edu (128.2.42.52)  248.915 ms  248.138 ms  243.709 ms
```

3. 课本第一章习题：

a) P5. 答：

经过一个收费站的传输时延 = 2min

端到端时延 = 3*经过一个收费站的传输时延+传播时延 = 3*2min + 150km / (100km/h) = 6min + 90min = 96min

b) P8. 答：

a. 能支持的用户 = 3Mbps / 150kbps = 20

b. P=0.1

c. $C_{120}^{n} p^{n} (1-p)^{120-n}$

根据中心极限定理：

令 X_j 为独立随机变量，$P(X_j=1)=p$；

$P(21\text{或更多用户}) = 1 - P(\sum_{i=1}^{120} X_i \le 21)$

$P(\sum_{i=1}^{120} X_i \le 21) = P\left(\frac{\sum_{i=1}^{120} X_i - 12}{\sqrt{120\times0.1\times0.9}} \le \frac{9}{\sqrt{120\times0.1\times0.9}}\right) \approx P(Z \le \frac{9}{3.286})$

$= P(Z \le 2.74) = 0.997$

因此 $P(21\text{或更多用户}) \approx 0.003$.

d.

c) P10. 答：

i. 端到端时延 = 2* dproc + d1/s1 + L/R1 + d2/s1 + L/R2 + d3/s3 + L/R3

ii. 端到端时延 = 2* 3ms + (5000km+4000km+1000km)/(2.5*10^5km/s)+3*1500*8/2Mbps = 6ms + 40ms + 18ms = 64ms