B-8-19. Consider the case where G(s) has one pole in the right-half s plane. From the Nyquist plot of $G(j\omega)$ shown on the next page, the -1 + j0 point is encircled by the $G(j\omega)$ locus once clockwise and once counterclockwise. Hence N = 0. Since G(s) has one pole in the right-half s plane, we have P = 1. Since

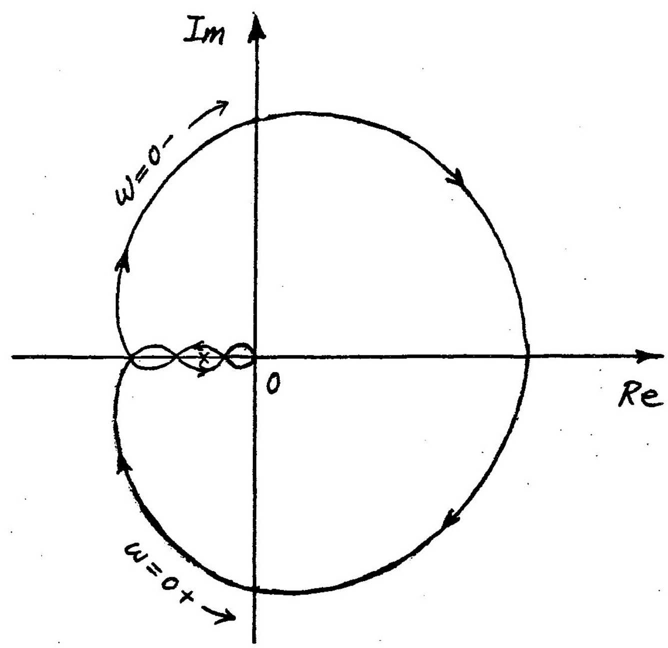
$$Z = N + P = 0 + 1 = 1$$

the system is unstable.

Next, consider the case where G(s) has no pole in the right-half s plane, but has one zero in the right-half s plane. The -1 + j0 point is encircled by the $G(j\omega)$ locus once clockwise and once counterclockwise. Hence, N = 0. Since G(s) has no poles in the right-half s plane, we have P = 0. Therefore,

$$Z = N + P = 0 + 0 = 0$$

The system is stable. (Note that the presence of a zero of G(s) in the right-half s plane does not affect the stability of the system.)



B-8-28.

$$G(s) = \frac{20(s+1)}{s(s^2+2s+10)(s+5)}$$

The phase margin, gain margin, phase crossover frequency, and gain crossover frequency are obtained by use of the command

[Gm, pm, wcp, wcg] = margin(sys)

A MATLAB program to solve this problem is given below. The Bode diagram shown below verifies the phase margin, gain margin, phase crossover frequency, and gain crossover frequency obtained with MATLAB.

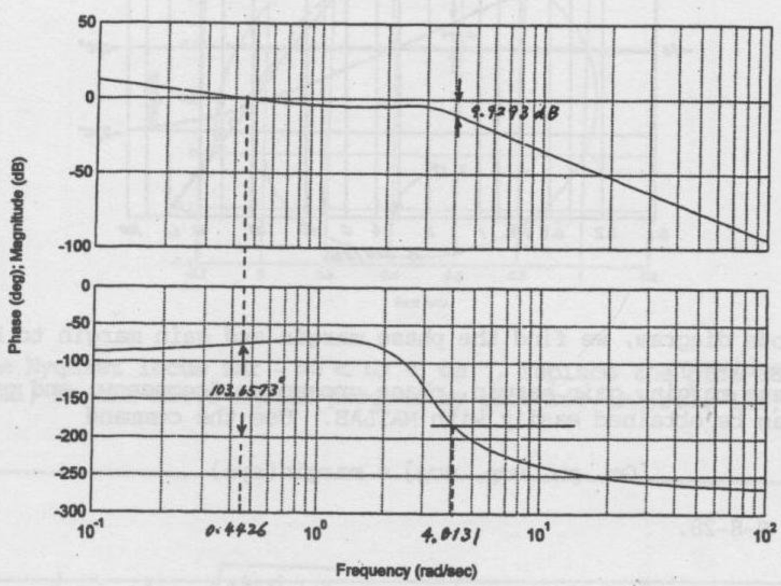
```
% ***** Bode Diagram *****

num = [0  0  0  20  20];
den = conv([1  2  10  0],[1  5]);
sys = tf(num,den);
w = logspace(-1,2,100);
bode(sys,w)
title('Bode Diagram of G(s) = 20(s+1)/[s(s^2+2s+10)(s+5)]')
[Gm,pm,wcp,wcg] = margin(sys);
GmdB = 20*log10(Gm);
[GmdB  pm  wcp  wcg]

ans =

   9.9293  103.6573   4.0131   0.4426
```

Bode Diagram of G(s) = 20(s+1)/[s(s^2+2s+10)(s+5)]



8-35:

$G(s) = 10 / (s*(0.17 s + 1))$