PROBLEM 1.1:
(2.5 points)

(a) Rods facilitate sharp vision. (Circle One)
   Ans: True  False

(b) Brightness is linearly proportional to luminance. (Circle One)
   Ans: True  False

(c) The luminance of an object depends on the luminance of the surround. (Circle One)
   Ans: True  False

(d) There are more cones than rods in the retina. (Circle One)
   Ans: True  False

(e) Simple cells have a circular receptive field. (Circle One)
   Ans: True  False

PROBLEM 1.2:
(3 points) There are many properties of the DTFT. You examined and derived these in the context of 1-D signals. Now consider extending these properties to the 2-D case. Complete the chart below.

\[
\begin{align*}
x(n_1, n_2) & \iff X(\omega_1, \omega_2) \\
x(n_1 - N_1, n_2 - N_2) & \iff \\
x(n_1, n_2)h(n_1, n_2) & \iff \\
x(n_1, n_2) \ast h(n_1, n_2) & \iff \\
e^{j(\theta_1 n_1 + \theta_2 n_2)}x(n_1, n_2) & \iff \\
\sum_{n_1=-\infty}^{\infty} \sum_{n_2=-\infty}^{\infty} x(n_1, n_2)y^*(n_1, n_2) & = \\
\sum_{n_1=-\infty}^{\infty} \sum_{n_2=-\infty}^{\infty} |x(n_1, n_2)|^2 & =
\end{align*}
\]
PROBLEM 1.3:
(3 points) Consider the following 2 × 3 subimage \( x(n_1, n_2) \) given by:

\[
x(n_1, n_2) = \begin{cases} 
5, & n_1 = 0 \text{ and } n_2 = 0 \\
10, & n_1 = 1 \text{ and } n_2 = 0 \\
2, & n_1 = 0 \text{ and } n_2 = 1 \\
4, & n_1 = 1 \text{ and } n_2 = 1 \\
3, & n_1 = 0 \text{ and } n_2 = 2 \\
6, & n_1 = 1 \text{ and } n_2 = 2 \\
0, & \text{otherwise}
\end{cases}
\]

(a) Is \( x(n_1, n_2) \) separable? Justify your answer to receive proper credit.
(b) Compute the DTFT \( X(\omega_1, \omega_2) \) of \( x(n_1, n_2) \).

PROBLEM 1.4:
(3 points) Consider the following 2-D discrete-domain signals:

\[
x(n_1, n_2) = \begin{cases} 
1, & 0 \leq n_1 \leq 3 \\
0, & \text{otherwise}
\end{cases}
\]

and

\[
v(n_1, n_2) = \begin{cases} 
1, & 0 \leq n_1 \leq 2, n_2 = 0 \\
0, & \text{otherwise}
\end{cases}
\]

(a) Plot \( x(n_1, n_2) \).
(b) Compute \( y(n_1, n_2) = x(n_1, n_2) * * v(n_1, n_2) \). (GIVE NUMERICAL VALUES).

PROBLEM 1.5:
(3 points) Consider the following subimage:

\[
x(n_1, n_2) = \begin{cases} 
u(n_2) \delta(n_1 - n_2), & n_1 < 3 \text{ and } n_2 < 3 \\
0, & \text{otherwise}
\end{cases}
\]

(a) Plot \( x(n_1, n_2) \).
(b) If \( x(n_1, n_2) \) is filtered using an LSI 2-D filter with impulse response \( h(n_1, n_2) = u(n_1, n_2) \), determine and plot the resulting filtered subimage \( y(n_1, n_2) \).