Appendix A

A.1 Conjectures

1. (Á. Baricz [45]) The inequality (3.23) holds for all $a,b>0$ and for all $r,s\in(0,1)$.
2. (Á. Baricz and E. Neuman [59]) The function $x\in\mathbb{R}\mapsto\mathscr{I}_p(x)\in[1,\infty)$ is strictly log-convex for all $p>-1$, while the function $x\in(0,\infty)\mapsto I_p(x)\in(0,\infty)$ is strictly log-concave for all $p>0$.
3. (Á. Baricz [54]) The function $x\in\mathbb{R}\mapsto\mathscr{I}_p^{(2k)}(x)\in(0,\infty)$ is strictly log-convex for all $k\in\mathbb{N}$ and $p>-1$, while the function $x\in(0,\infty)\mapsto\mathscr{I}_p^{(2k+1)}(x)\in(0,\infty)$ is strictly log-concave for all $k\in\mathbb{N}$ and $p>-1$.
4. (Á. Baricz [54]) The inequality (3.97) holds for all $a,b\geq 0$ and $p>-1$.
5. (Á. Baricz and S.Wu [63]) The inequality (3.169) holds for all $p\in(-1,p_0)$ and $|x|<j_{p,1}$, while (3.170) and (3.171) hold for all $p>-1$ and $|x|<j_{p,1}$.

A.2 Open Problems

1. (Á. Baricz [43]) Find the explicit range of b,c,p for which u_p is univalent in $\mathbb{D}$.
2. (S. András and Á. Baricz [24]) Is it true that if $p>-1$ increases, then the image region $\mathscr{J}_p(\mathbb{D})$ decreases, more precisely if $p>q>-1$, then $\mathscr{J}_p(\mathbb{D})\subset\mathscr{J}_q(\mathbb{D})$? This problem is related to Corollary 2.14 which provides a partial affirmative answer. Namely, it is true that if $p>q\geq-1/4$, then $\mathscr{J}_p(\mathbb{D})\subset\mathscr{J}_q(\mathbb{D})$.
3. (Á. Baricz [41]) For which $b,p,c\in\mathbb{R}$ does $\sigma(r_1)+\sigma(r_2)\leq 2\sigma(\sqrt{r_1r_2})$ hold for all $r_1,r_2\in(0,1)$, where $\sigma(r)=u_p(1-r^2)/u_p(r^2)$?
4. (Á. Baricz [41]) Suppose that the power series $f(r)=\sum_{n\geq 0}A_nr^n$ is convergent for all $r\in(0,1)$, where $A_n>0$ for all $n\geq 0$. Let us consider the function $m_f:(0,1)\to(0,\infty)$, defined by $m_f(r)=f(1-r^2)/f(r^2)$. Find conditions concerning the coefficients A_n, which guarantee that $m_f(r_1)+m_f(r_2)\leq 2m_f(\sqrt{r_1r_2})$ for all $r_1,r_2\in(0,1)$.

A.3 Matlab Programs for Graphs

1. **Fig. 1.1**
```
x=0:0.1:10;
y1=besselj(-1/2,x);
y2=besselj(0,x);
y3=besselj(1/2,x);
plot(x,y1,'b.');hold on;
plot(x,y2,'g');
plot(x,y3,'r--');
```
2. **Fig. 1.2**
```
x=0:0.1:4;
y1=besseli(-1/2,x);
y2=besseli(0,x);
y3=besseli(1/2,x);
plot(x,y1,'b.');hold on;
plot(x,y2,'g');
plot(x,y3,'r--');
```
3. **Fig. 2.1**
```
clear;
fi=0:0.001:2*pi;
z=cos(fi)+i*sin(fi);
gz=cos(z);
plot(z,'g'); hold on;
plot(gz,'b');
axis equal;
axis([-1.1 1.6 -1.1 1.1]);
```
4. **Fig. 2.2**
```
clear;
fi=0:0.001:2*pi;
z=cos(fi)+i*sin(fi);
fz=sin(z)./z;
plot(fz,'r');hold on;
plot(z,'g'); hold on;
axis equal;
axis([-1.1 1.6 -1.1 1.1]);
```
5. **Fig. 2.3**
```
clear;
fi=0:0.001:2*pi;
z=cos(fi)+i*sin(fi);
fz=sin(z)./z;
gz=cos(z);
plot(fz,'r');hold on;
plot(z,'g'); hold on;
```

```
plot(gz,'b');
axis equal;
axis([-1.1 1.6 -1.1 1.1]);
```

6. **Fig. 2.4**

```
clear;
fi=0:0.001:2*pi;
z=cos(fi)+i*sin(fi);
fz=sin(z)./z;
gz=cos(z);
hz=3*((sin(z))./(z.^3)-(cos(z))./(z.^2));
plot(fz,'r');hold on;
plot(z,'g'); hold on;
plot(gz,'b');
plot(hz,'y');
axis equal;
axis([-1.1 1.6 -1.1 1.1]);
```

7. **Fig. 3.1**

```
clear;
plot(0,1,'o');hold on; %point A
plot(pi/2,2/pi,'o'); %point B
x=0:0.05:2;
y1=2/pi-4/(pi^2)*(x-pi/2);
y2=sin(x)./x;
y3=1+2/pi*(2/pi-1)*x;
plot(x,y1,'r.'); hold on;
plot(x,y2,'g');
plot(x,y3,'b-.');
```

8. **Fig. 3.2**

```
clear;
x=-1.5:0.1:1.5;
y1=2/9*(2+5/2*cos(sqrt(3/5)*x));
y2=sin(x)./x;
y3=cos(x/sqrt(3));
plot(x,y1,'b.-'); hold on;
plot(x,y2,'r.');
plot(x,y3,'g');
```

9. **Fig. 3.3**

```
clear;
x=0:0.05:pi/2;
y1=cos(x);
y2=(pi^2-4*x.^2)./(pi^2+4*x.^2);
y3=((pi^2-4*x.^2)./(pi^2+4*x.^2)).^(pi^2/16);
plot(x,y1,'g'); hold on;
plot(x,y2,'b.');
plot(x,y3,'r-.');
```

10. Fig. 3.4

```
clear;
x=0:0.01:pi;
y1=sin(x)./x;
y2=(pi^2-x.^2)./(pi^2+x.^2);
y3=((pi^2-x.^2)./(pi^2+x.^2)).^(pi^2/12);
p1=plot(x,y1,'g'); hold on;
p2=plot(x,y2,'b.');
p3=plot(x,y3,'r-.');
set(p2,'Markersize',1);
set(p3,'Markersize',1);
```

11. Fig. 3.5

```
clear;
x=0:0.01:1.5;
y1=tan(x)./x;
y2=(pi^2+4*x.^2)./(pi^2-4*x.^2);
y3=((pi^2+4*x.^2)./(pi^2-4*x.^2)).^(pi^2/24);
p1=plot(x,y1,'g'); hold on;
p2=plot(x,y2,'r.-');
p3=plot(x,y3,'b.');
set(p2,'Markersize',4);
set(p3,'Markersize',4);
```

12. Fig. 3.6

```
clear;
x=0:0.01:1.5;
y1=cosh(x);
y2=ones(1,length(x));
y3=((pi^2+4*x.^2)./(pi^2-4*x.^2)).^(pi^2/16);
p1=plot(x,y1,'g'); hold on;
p2=plot(x,y2,'b.');
p3=plot(x,y3,'r-.');
set(p2,'Markersize',4);
set(p3,'Markersize',4);
```

13. Fig. 3.7

```
clear;
x=0:0.01:3;
y1=sinh(x)./x;
y2=ones(1,length(x));
y3=((pi^2+x.^2)./(pi^2-x.^2)).^(pi^2/12);
p1=plot(x,y1,'g'); hold on;
p2=plot(x,y2,'b.');
p3=plot(x,y3,'r-.');
set(p2,'Markersize',4);
set(p3,'Markersize',4);
```

14. Fig. 3.8

```
clear;
x=0:0.01:pi/2;
y1=tanh(x)./x;
y2=ones(1,length(x));
y3=((pi^2-4*x.^2)./(pi^2+4*x.^2)).^(pi^2/24);
p1=plot(x,y1,'g'); hold on;
p2=plot(x,y2,'b.');
p3=plot(x,y3,'r-.');
set(p2,'Markersize',4);
set(p3,'Markersize',4);
ylim([0 1.1]);
```

15. Fig. 3.9

```
clear;
x=0:0.01:1;
g=0.577215665;
y1=gamma(x)-(1-x)./(1+x).*(exp((1-g)*x)./(x));
p1=plot(x,y1,'b');
set(p1,'Markersize',4);
```

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